Message From The Minister

Hon. O. O. MADSEN, M.L.A.,
Minister for Agriculture and Forestry.

We have been through a difficult year on the land, and while there have been serious casualties, there have also been victories.

Last year more farmers than ever before were able to prove to the satisfaction of others, as well as themselves, that advanced farming methods moderate the depredations of drought. These farmers have adopted a scientific, balanced farming that had to be picked up from somewhere, studied, and applied.

In the majority of cases they received at least part of their information directly or indirectly through the efforts of our Department's research workers and extension officers.

There are already a large number of research stations being run by the Department in many parts of Queensland (the present score is 26), and it would be financially and physically impossible to establish and staff any more at the present time. But there is another effective way of tackling the problem of discovering and distributing scientific farming facts throughout the country.

I refer to what is known as farmer co-operation.

By this term is meant the action by some farmers who put part of their properties, part of their time, part of their labour, part of their finances, and a large amount of interest and enthusiasm at the disposal of Department officers for the carrying out of research and experimentation.

There is two-way co-operation between the farmer and the Department in identifying farming problems and attempting to solve them. And I emphasise that the co-operation is two-way.

From this mode of operation, the results of work done on a farmer's property, if beneficial, can be disseminated among all the farmers in the area.

There are now, and have been for some time, a large number of farmers in Queensland who can be called farmer co-operators, and to these men the Department and the whole farming community owe unfathomable gratitude.

It would be hard to find a better way of teaching farming practices than by example. That is why these farmer co-operators, who set the example in new farming methods, are making such a worthwhile contribution to our future.

The Department, in the years to come, looks for continued and increased support from farmer co-operators, and directs the attention of the State to the valued service to farming that these men are offering.

I take this opportunity of sending seasonal greetings to all primary producers throughout Queensland.

Otto Madsen

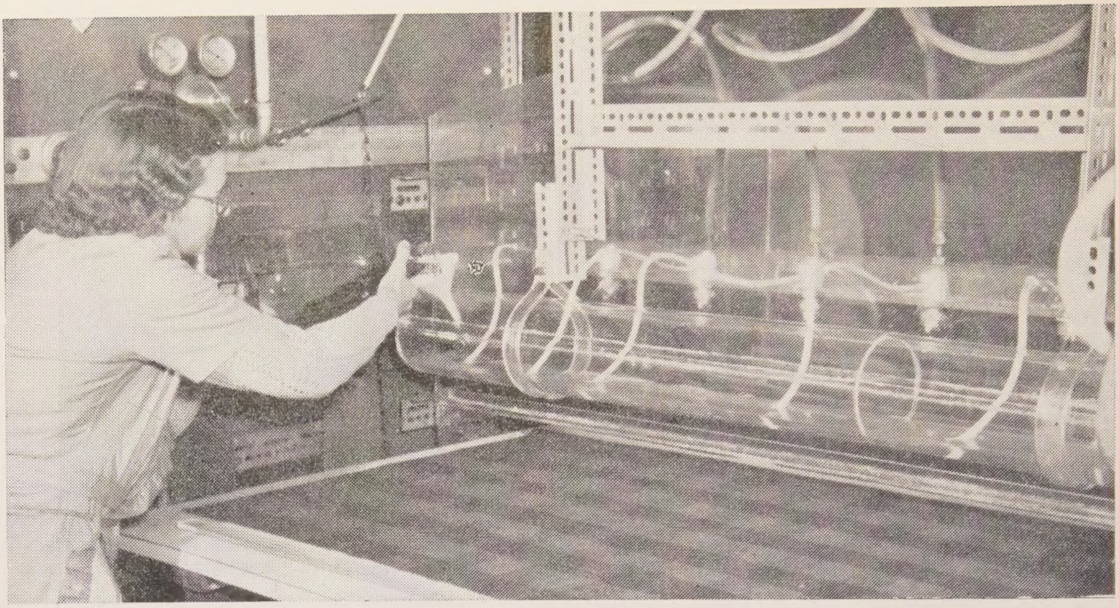

Plate 1

Getting Ready to Spray. The cylinder tube of this new Si-Ro-Set machine is filled with thioglycollic acid, which has the power to keep permanent pleats or creases in pure wool. The flat material is placed beneath the cylinder ready to receive the finish, before being pleated.

—Australian Wool Bureau Photo.

Wool Accepts The Challenge

By M. D. RICHARDS, Assistant Wool Technologist.

Since the Stone Age, man has herded sheep and woven wool; and wool has been the foundation of prosperity of many nations. To poet and peasant alike, wool was "the flower and strength and revenue and blood of England." To this day the Lord Chancellor still takes his seat in the House of Lords on the woolsack—a bale of wool placed there in the time of Edward III to remind peers of the importance of their staple trade. Lately the British Commonwealth's wool production has grown vastly, while England's own production has declined.

With modern competition from synthetic fibres, some people fear a similar decline will be suffered by Australia; others claim that wool's intrinsic virtues will enable it to stand firm against the challenge.

To attract consumers, the manufacturers of synthetic fibres have stressed as selling points that their fibres are shrink-resistant, permanent creasing, resistant to insects, and with wash and wear laundering qualities. Due to research performed by the C.S.I.R.O., claim can be made that wool has all those assets and still retains its warmth, elasticity, and draping qualities.

These properties have been gained by the use of processes called Si-Ro-Fix, Si-Ro-Set, Si-Ro-Moth'd, and Sironized.

Si-Ro-Fix is a method of shrink-proofing woollen fabrics using a chemical pre-treatment and a particular polyamide resin. The application is such that the fibres of the yarn are more or less "spot-welded" together, thus preventing shrinking during washing.

Si-Ro-Set is a simple treatment that produces long-lasting pleats or creases by the use of a chemical similar to that used in the permanent waving of the hair. This process does not damage the material and the pleatings are retained after laundering or dry cleaning.

Dieldrin, the same chemical used in combating sheep blowfly activity, forms the basis of the process called Si-Ro-Moth'd. It was found that

Plate 2

The Completed Garment is Removed from the Cardboard Pleating Pattern with the new Si-Ro-Set Finish of Permanency. Before pleating, the material has already been hemmed so that each crease falls into perfect precision.

—Australian Wool Bureau Photo.

dieldrin is a most effective moth-proofing agent even when used at a very low concentration. This chemical was found to be persistently effective even after both washing and dry cleaning.

During the development stages of Si-Ro-Set, it was noticed that the surface of the treated cloth appeared unaffected when it was wetted. This suggested that a "wash and wear" garment might be produced, provided it was previously proofed against shrinking. Further development produced a "flat set" fabric having "wash and wear" properties. This process was called Sironizing.

Many synthetics burn readily and can be real fire hazards. Wool, on the other hand, is very difficult to set on fire.

Many accidents from fire could be less serious if the advantages of wool and the dangers of certain other materials were more widely known. Wool is a great asset in the event of a fire; it resists flame and only after prolonged heating will it catch alight. It then burns with difficulty. Rayon ignites readily and other synthetics such as nylon, orlon and others melt on heating and can then burn. These synthetics with low melting points will run into holes when touched by sparks or are held too close to heated surfaces.

What better proof of wool's fire-resistant qualities is needed than the fact that firemen prefer woollen clothing for protection against flame?

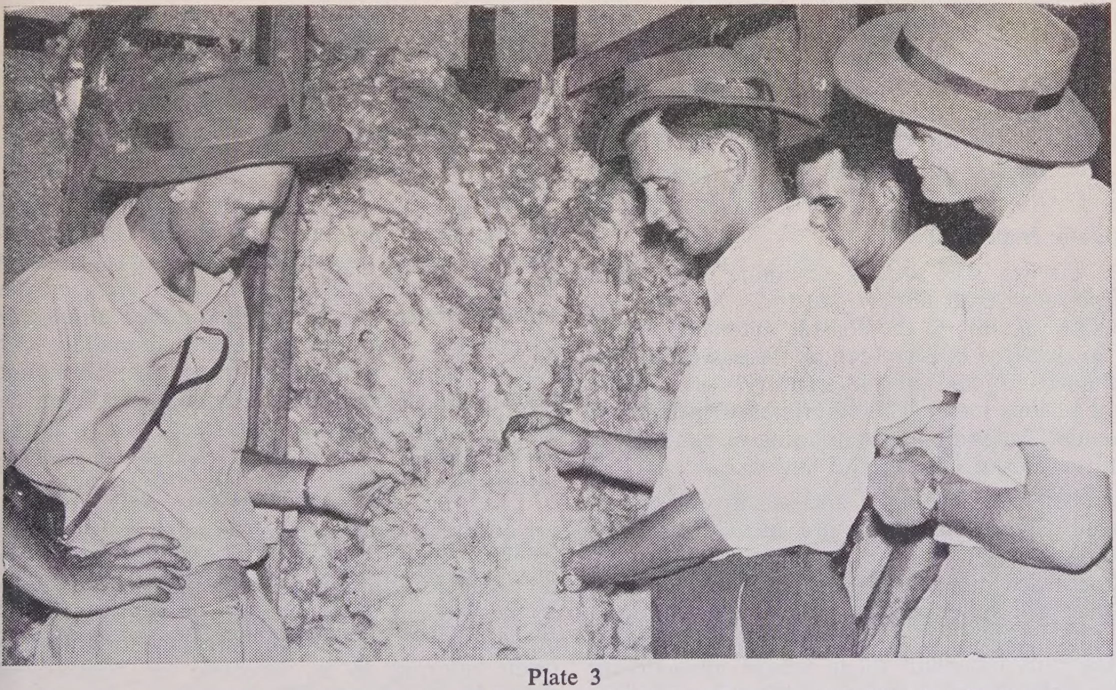

Plate 3

The Character of Wool in the Fleece is Examined by Junior Farmers Attending the "Science in Farming" Course at Gatton College.

Tick Fevers Of Cattle In Queensland

By C. R. MULHEARN, Director of Veterinary Services.

Tick fever and redwater, the popular names applied to a disease of cattle caused by extremely small blood parasites transmitted under natural conditions by the cattle tick, *Boophilus microplus,* occur only within the tick-infested zones.

Introduced into northern Australia with the tick towards the end of the last century, it accompanied that pest in its spread southwards through Queensland.

The initial outbreaks of the disease caused many deaths, often exceeding 50 per cent. of the local cattle population. As the tick became established, however, the remaining cattle acquired resistance, and because most young cattle bred in tick-infested country develop a natural resistance, the disease is usually now responsible for only comparatively small losses within the tick-infested area.

Cattle continually exposed to tick infestation carry these small blood parasites in their systems and are immune, whereas most cattle which have been bred in tick-free country will readily contract the disease if exposed to tick infestation. Such animals are referred to as being susceptible.

Economic Importance

The disease is of serious economic importance to the Queensland cattle industry. As the tick is confined mainly to the coastal watershed, cattle bred in tick-free country cannot be moved to and maintained in tick-infested country without the risk of serious loss. This interferes with the free movement, fattening and marketing of cattle from inland to coastal Queensland and vice versa.

Another form of loss and inconvenience is incurred when stud cattle are introduced from clean districts into the tick area. If these cattle are forwarded direct to the holdings, it is certain that they will suffer an attack of tick fever, often with fatal results, and consequently it becomes necessary to inoculate them before introduction to the tick-infested country. After inoculation, such animals are usually resistant to infection.

Frequently, losses occur in cattle in margina country—that is, country situated between th definitely tick-infested and the definitely tick-fre country. Owing to seasonal and other conditions the animals in these marginal areas may not b exposed to ticks for several months or even years and consequently become susceptible to tick fever When they are again exposed to ticks, as the may be in a favourable season, severe losses ar likely to occur.

Losses are also occurring continually in cattl within the tick zone. This happens particularl in areas where dry seasons cause a diminution i the number of ticks or where these parasites hav been killed out by too frequent dippings.

Method of Transmission

As already stated, tick fever is an infectiou disease caused by small blood parasites spread b means of the cattle tick, and does not occur wher the tick is non-existent.

The tick spends the whole of its parasitic lif on the same animal, and if this animal is a "carrier" these blood parasites are taken up b the tick, which transmits through its eggs thes same parasites to its progeny, the larval ticks which pass them into a second animal to whic the progeny, in their turn, attach. In this manner most cattle in tick-infested country are being constantly reinfected, and this keeps them immun to the disease.

Ticks, as such, are therefore not responsibl for outbreaks of tick fever, but the disease result from the blood parasite passing from one generation of ticks to the next. For reasons not know at the present time, all ticks do not carry thes organisms. Ticks which carry the organism ar often referred to as infective or "pathogenic" ticks, but to outward appearances they are n different from non-infective ticks.

It has been stated that different types of ticks ansmit different forms of tick fever, but this is fallacy, as there is only one common cattle tick Queensland and this one transmits all forms of ck fever.

Outbreaks of tick fever develop only when fective ticks become attached to susceptible ttle.

There is quite a pronounced variation in susceptibility in different ages and types of cattle. oung animals have a strong natural resistance; ence they usually contract the disease in a mild rm but develop an immunity, which is maintined provided they are exposed to a certain egree of tick infestation. This age resistance radually decreases, and seems to be largely lost hen the animal is 9 to 12 months old—that is, the event of the animal *not* being exposed to ck infestation.

As a general rule, healthy cattle in good condion are less susceptible than weaker animals.

The incidence of the disease varies from year o year. It is usually most prevalent in a good eason, when conditions are suitable for tick propaation, following a series of dry seasons.

ymptoms

For many years, it was considered that tick ever in Australia was caused by a single blood arasite, but it is now known that several rganisms may be responsible for different forms f the disease. The most important of these are *abesia bigemina* and *Babesia argentina,* both of hich produce symptoms of redwater, and *Analasma marginale,* which produces a more chronic ype of disease.

The first symptom in the redwater form of the isease is fever, and this may be noted even while he animal is apparently normal in other respects. he temperature gradually rises over a period of ays, and it may reach a maximum of 106 to 108 eg. at the height of the fever. In milking cows, here is usually a marked reduction in milk yield hortly after the onset of the fever. Scours may e evident in the early stages, though constipation sually follows.

A few days after the onset of fever, the appetite s depressed and the animal will isolate itself and tand in the shade. At this stage, the ears droop nd the coat is roughened. Jaundice then becomes vident, and may be noted from an examination f the eyes or mouth. It may be difficult to detect n Jersey cattle. Red urine may also be passed, and this must be looked upon as a very serious symptom, for the animal is then in an advanced stage of the disease. In this advanced stage, the eyes are staring, the muscles quiver, and the animal is unsteady on its feet; it finally collapses, becomes unconscious and dies. Sometimes, the animal struggles just before death.

In the less severe cases, in which the animal recovers, it may or may not reach the stage of redwater and then gradually improves, finally coming back on to its feed after a period of several days. In such cases, the animal loses condition, the blood becomes weak and there is a definite pallor about the mouth and eyes. The crisis is usually passed in less than a week.

In the anaplasmosis form, the course is less severe but more prolonged, and the animal loses much condition and becomes weak. It may take months to recover completely.

Post-Mortem Changes

The carcass may show small bleedings throughout the tissues, which are often stained a definite yellow colour, particularly noticeable in the fat, due to generalised jaundice.

The body cavity may contain a quantity of blood-stained fluid, whilst the liver is usually enlarged and bronze coloured. The gall bladder may be full of thick bile. The spleen is very enlarged, sometimes up to twice its normal size, and instead of being firm it feels soft and doughy and the interior is of a semi-fluid consistency.

The kidneys are often darker in colour than normal, and enlarged. The bladder usually contains a quantity of urine, which may vary from a dirty red to a port wine colour. This, however, is not a constant feature, for on rare occasions an animal may die of tick fever and the urine remain a dark amber colour.

Animals which die of the anaplasmosis form of tick fever show evidence of loss of condition, generalised jaundice and extreme pallor due to poverty of the blood, but the urine remains normal in colour or is a dark amber.

Anaplasmosis is fairly rare and tends to occur in restricted areas. The majority of tick fever deaths are due to the redwater forms, and particularly the form known as babesiosis.

Difficult Diagnosis

The foregoing symptoms and post-mortem findings are those encountered in typical cases, which should be diagnosed without much difficulty. However, an atypical case is sometimes encountered, and some difficulty may be experienced in

Plate 1

Inoculating a Beast. The method of inoculation is identical for both the preventive and the curative treatments.

making a field diagnosis. Again, there are other diseases which present both ante and post mortem findings very similar to those of tick fever, and in such cases it becomes necessary to enlist the aid of the laboratory in obtaining a correct diagnosis.

Specimens to be submitted for this purpose are blood smears from the live animal (Plate 3), and, from the dead animal, smears from the kidney, grey matter of the brain, heart muscle, liver and spleen are most suitable in the order outlined.

A smear is made by spreading a small drop of blood very thinly over the glass slide and drying it rapidly. Blood for this purpose may be collected from the ear or more easily from the tip of the tail.

Specimens such as portions of the kidney and a small quantity of urine may also assist in arriving at a diagnosis. An oxalated blood sample for haemoglobin estimation is also useful.

Diseases which may be confused with tick fever are lantana poisoning, leptospirosis, enzootic haematuria and other liver diseases.

In lantana poisoning, there is generalised jaundice, but no red urine. Other typical features of this condition are peeling of the nose and black scours.

Leptospirosis is very similar in many respects to tick fever and is frequently seen in its worst form in young calves up to 6 months old. Bu it also affects aged cattle. Red urine is a prominent symptom of this disease.

Enzootic haematuria chiefly affects aged cows, hich pass blood and blood clots in the urine. t is a more chronic disease than tick fever.

reatment

Fortunately, the redwater forms of tick fever ay be treated successfully with certain special reparations, such as Acaprin, Ludobal, Pirevan, iroparv, Babesan, &c., which can be obtained rom most chemists. These are usually in the orm of a solution put up either in ampoules Plate 2) or in 50 c.c. rubber-stoppered bottles. he preparation must be injected under the skin y means of a hypodermic syringe, and the dose ate is 1 c.c. per cwt. liveweight up to a maximum f 6 c.c. In serious cases, if the animal does not how signs of improvement within 12 hours after e injection of a single dose, treatment should e repeated.

Another recent and very promising drug is Gonacrine. Its use is limited to veterinarians, however, because it must be given intravenously or it causes extreme tissue reaction and sloughing.

These drugs are very effective, particularly if given during the early stages, and evidence of recovery will usually be noted in less than 24 hours, with complete recovery in a few days.

In advanced cases, more difficulty may be experienced in effecting a recovery, and it may be necessary to give two or even three doses at 12-hourly intervals.

In some instances, owners should be able to anticipate outbreaks of tick fever—for example, when susceptible cattle are inoculated or moved onto tick-infested country—and they should be prepared to treat these cases before they become too advanced. A morning temperature of over

Plate 2

Drawing Blood for Inoculation from a "Bleeder". The blood is taken from the jugular vein into a sterilized bottle.

Plate 3

Taking a Blood Smear for Diagnosis of Tick Fever. A vein in the ear is pricked, a drop of blood is spread thinly on a glass slide, and the smear dried rapidly.

105 deg. should be looked upon seriously, and the animal treated, particularly if it is showing any other signs of illness.

In the tick-infested area, any cattle which show signs of sickness and fever, without an obvious reason, should be suspected of developing tick fever and treated as a precautionary measure. No ill-effect is likely to result from the treatment if the animal is not suffering from tick fever. The only exception to this rule is where leptospirosis may be the trouble. In these cases it may be wiser to use an antibiotic such as Aureomycin. The drug, however, has no value as a preventive and will not be effective unless given when the animal is actually suffering from the disease.

If it is necessary to move animals to yards for treatment, they should be taken very quietly, as over-driving aggravates the fever and may cause collapse and death. Cattle should be allowed to settle down before treatment as the drugs are toxic in excited animals.

If an outbreak occurs in travelling cattle, they should be spelled at some convenient place and the affected animals quietly drafted off for treatment.

Prevention and Immunisation

Frequently, it is necessary to transfer susceptible cattle from tick-free to tick-infested areas and unless certain precautions are taken in such cases, losses are certain to occur following exposure of the animals to ticks.

This precaution may take the form of preventive inoculation (Plate 1) and/or treatment with a tick repellant dipping fluid, such as DDT solution. The DDT treatment would be satisfactory if the animals were being held for temporary periods in tick-infested country, and they would have to be treated at 7-day intervals. If the animals were to be held permanently on tick-infested pastures, inoculation would be necessary.

Inoculation consists of an injection of blood freshly drawn from a specially prepared animal

(Plate 2). Several systems of inoculation may be used according to circumstances.

One system consists of a double inoculation, using firstly *Babesia bigemina* blood, which gives a relatively mild reaction, and about a month later *Babesia argentina* blood, which fortifies the resistance produced from the first inoculation.

These inoculations are best carried out before exposure to tick infestation, so that the animals will have a strong resistance to tick fever when subsequently exposed to ticks. If these inoculations are carried out at, or soon after, the time of arrival in tick-infested country, it would be desirable to regularly dip the animals in DDT or similar preparations to minimise the risk of tick infestation until the reaction has passed.

It is not usually practicable to undertake this double inoculation, so blood containing both these organisms is used. The risk of severe reactions is greater with this method, and so precautionary measures are taken and the cattle must be kept under close observation or losses may occur.

Inoculation with a mild form of anaplasm may be combined with either of the methods.

After inoculated cattle are exposed to ticks, they should be watched carefully for about one month. If no outbreak occurs within this time, it can be assumed that the inoculation has been successful and the animals will remain immune. When practicable, a second inoculation is always worthwhile.

Cows which are heavy in calf should not be inoculated, for a severe reaction may bring on abortion.

Cattle Which Should be Inoculated

All cattle believed to be susceptible to tick fever should be inoculated. Immunization of stud cattle is often carried out at Departmental laboratories. Blood for inoculation may be obtained from Animal Health Stations but it should be used within 24 hours after despatch from the laboratory.

If a large number of animals are to be inoculated, it may be more convenient to take a specially prepared bleeder to the place where the inoculation is to be done, and bleed it immediately before the inoculations.

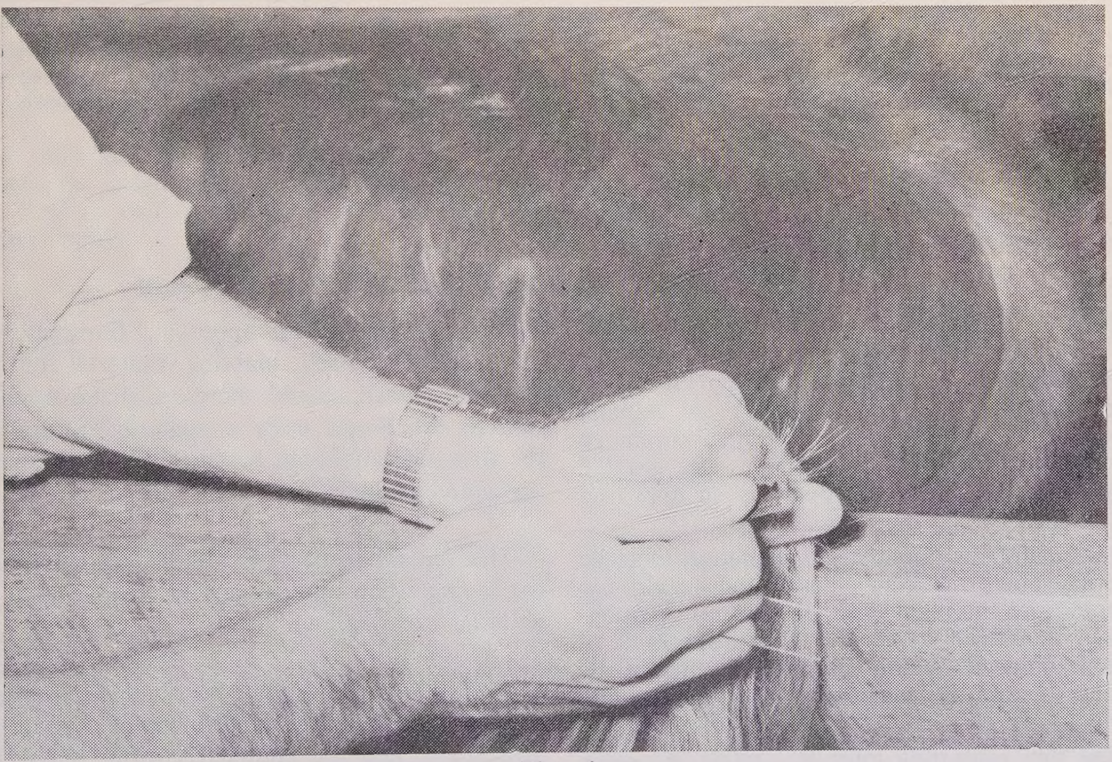

Plate 4

Preparing to take a Blood Smear from the Tip of the Tail Has Proved Just As Good and Involves Less Restraint of the Animal. First clip the hairs from the tip of the tail and clean any debris away.

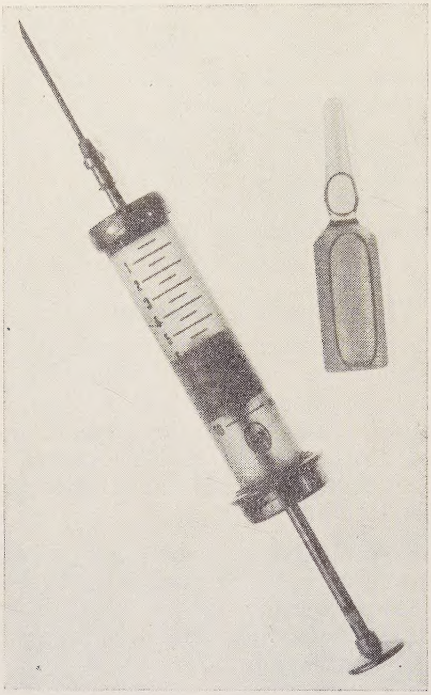

Plate 5
Syringe and Ampoule Ready for Injection of Drug.

Inoculations are also carried out regularly in the "marginal" country, and in any other area where the degree of tick infestation is light and subject to fluctuation.

Owners can frequently anticipate any marked increase in the degree of tick infestation and inoculate as a precautionary measure; in other cases, inoculations must be regularly practised each year to avoid losses.

Both blood and bleeders for this work can be obtained from the Animal Research Institute at Yeerongpilly (near Brisbane) and the Animal Health Station at Oonoonba (near Townsville). It is appreciated if orders for blood are placed 48 hours before it is required.

When bleeders are held on the property for any length of time, one of two things may happen. Firstly, if not regularly reinfected with pathogenic ticks they may lose their immunity. Secondly, they may pick up infection with undesirable field strains of tick fever, particularly Anaplasma, and become dangerous to use. Management should therefore be arranged so that as many cattle as possible are inoculated as soon as the bleeder arrives. He is then fattened and sold off as a bullock. The time in which a bleeder can lose his immunising power is very variable but it can be very short and the practice of keeping one bleeder for years is a most shortsighted one.

Banana Planting Material

Growers who desire to sell planting material of Lady Finger or Sugar bananas during the 1961 planting season, which commences on August 1, 1961, are reminded by the Banana Industry Protection Board that permits to remove planting material of those varieties are granted only when the source of supply is an approved plantation.

To qualify for approval, a plantation must be well managed, free from panama and bunchy top diseases and the plant type must be up to recognised commercial standards. Two inspections of each nominated plantation will be made by officers of the Department of Agriculture and Stock.

The first inspection must be carried out some time between March 1 and May 31. Any plantation which is not inspected during that period will not be eligible for approval. Growers who may desire to sell planting material of the varieties named should therefore make application to the Board early enough to ensure that the first inspection can be carried out within the appointed period.

The second inspection will be carried out in the spring when applications to remove planting material are required.

Application forms may be obtained from the district offices of the Department of Agriculture and Stock, and the completed forms should be lodged with the Board's agents as early as possible and not later than March 31, 1961.

Apple Diseases

By K. N. SHEA, Pathologist.

Disease-free apples may be produced in Queensland by routine control of two diseases and occasional control of some others.

Apples grown in Queensland are not attacked by disease so seriously as in other parts of the world. This is due partly to the action of quarantine in keeping out diseases such as fire blight and apple rust. Also the climate in the State's only major apple-producing area, the southern highlands around Stanthorpe, tends to be unfavourable for some diseases.

Orchardists must keep a watch for scab and powdery mildew, however, and take action to ensure that neither builds up. A watch must also be kept for several other diseases and appropriate action taken if they occur.

In addition to the diseases described here, apples are affected by several disorders of nutritional or physiological origin.

A schedule of recommended routine sprays follows the descriptions of the diseases, but should be read in conjunction with the text for non-routine sprays.

ROUTINE SPRAYS

Time of Application	Diseases	Spray Formulae
Green tip . .	Scab	Bordeaux 15–10–100
Pink stage . .	Powdery mildew Scab	Lime sulphur, 3–100 plus casein spreader ; *or* (for scab only) thiram, 1½ lb.–100 gal. ; *or* captan 2 lb.–100 gal. ; *or* " Melprex " ¾ lb.–100 gal. ; *or* glyodin 2 pt.–100 gal.
Calyx stage (late October)	Powdery mildew Scab	Lime sulphur, 1–100 plus casein spreader ; *or* (for scab only) thiram, 1½ lb.–100 gal. ; *or* captan 2 lb.–100 gal.; *or* " Melprex " ½ lb.–100 gal. ; *or* glyodin 2 pt.–100 gal.
Cover sprays as required	Scab	Thiram 1½ lb.–100 gal. ; *or* captan 2 lb.–100 gal. ; *or* " Melprex " ½ lb.–100 gal. ; *or* glyodin 2 pt.–100 gal.
	Powdery mildew	Sulphur *or* " Karathane "

For other diseases, additional sprays may be needed—see text. Recommendations for control of insect pests are contained in other departmental publications ; they are essential to production of marketable fruit.

SCAB (BLACK SPOT)

Throughout most of the world, scab is one of the most important diseases of apples; losses to it are often serious. It was first noticed in Queensland in 1895. For many years there were sporadic outbreaks but they were never very important. Control measures were almost unknown. Since about 1950, the disease has been much more common. The reason for this change is not known but could be the occurrence or introduction of a new strain of the fungus, favourable weather, the establishment of large new apple areas commonly adjacent to one another, or any combination of these.

Scab is now recognised as a disease against which some routine precautions must be taken every year; in some years a full control programme may be necessary.

Symptoms

Leaves and fruit are commonly attacked; more rarely twigs may be affected.

The **leaf** spots are usually the first symptom seen. They appear first as olive-green spots about one-eighth in. diameter; on very young leaves the lower surfaces are attacked but on more mature leaves it is usually the upper surfaces that are invaded. The spots darken and eventually are almost black; the edges are broken and on young leaves may have a feathery appearance. Older spots tend to have a more definite outline. When heavy infection occurs the leaves will be distorted and reduced in size.

Fruit symptoms are very similar to those on the leaves. But if the fruit are infected early they are usually distorted and cracked (Plate 1). The fungus grows under and breaks up the cuticle so that, especially on large fruit, the broken grey edge of the lifted cuticle can be seen surrounding the spots.

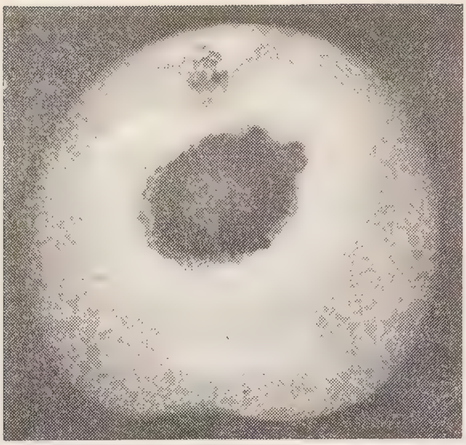

Plate 1

Scab (black spot). Old infection. Note that the fruit is starting to crack.

Cause and Disease Cycle

Scab is caused by a fungus, *Venturia inaequalis*. Spores of this fungus are present around the trees every spring, are blown about like dust and settle on the young leaves. In the presence of free moisture the spores germinate and infect the tissue; within a week or two (depending on temperatures) a new crop of spores is produced and released to re-start the cycle if conditions are favourable.

The term "free moisture" should be noted; high humidity alone is not sufficient for spore germination. In effect this means that most damage is liable to occur in cool overcast showery weather; if this occurs in spring when there is much young fruit and leaf tissue, the results can be serious. Further, scab will tend to be worse on shaded sides of trees because free moisture does not evaporate quickly there. The fungus lives over winter on dead leaves.

There is a deal of variation in the susceptibilities of different cultivated varieties. However, of the three varieties important in Queensland two, Delicious and Granny Smith, are subject to infection. Of these Granny Smith seems by far the more susceptible. In view of that variety's current importance in Queensland orchards (about 50 per cent. of new plantings), control of scab has to be sought in some way other than planting resistant varieties.

Complete destruction of overwintering leaves would considerably reduce the primary infections in spring. That is an unattainable ideal but orchardists should see that all possible leaves are ploughed in or otherwise destroyed during winter. If an orchard has had some scab and the owner wishes to reduce carry-over greatly, he may use a post-harvest spray in addition to normal measures.

Normal effective control depends on keeping the rapidly expanding plant parts protected with sprays during the period of maximum growth of susceptible tissues and when weather conditions are favourable to infection. Since the weather cannot be forecast long ahead with any accuracy, it is usually necessary to treat sprays in early spring much like the premium on an insurance policy, that is, apply the sprays automatically without knowing in advance if they are vitally necessary. Later, cover sprays are usually applied in accord with the weather actually experienced. Thus, in Queensland, it is often satisfactory to omit all cover sprays if spring and summer are dry; if they are showery and overcast, a full programme will be needed.

In some countries where apples are grown over extensive areas with a simple topography, warning services operate to tell growers when meteorological readings show that infection will have occurred. Such a service is at present impracticable in Queensland for two reasons. Firstly, the extreme local variability in the weather from valley to valley and from orchard to orchard in the southern highlands around Stanthorpe makes any such scheme here of limited value. Secondly, such services warn that infection has already occurred, not that it is about to occur. It therefore becomes necessary to use eradicant fungicides; these leave poisonous residues which may lead to the fruit being condemned by public health authorities.

There are several fungicides that will control scab fairly well. It is possible to use organic chemicals right through but it is a better and more economical plan to use sulphur (as lime-sulphur) in the early sprays; in that way one mixture controls powdery mildew as well as scab. For the first spray at green tip when the trees are just starting to move in spring, control of powdery mildew is of no importance, so the very effective, tenacious, and relatively cheap Bordeaux mixture can be used. If used later, Bordeaux may cause some spray burn.

A practical spray programme thus becomes—Bordeaux mixture at green tip, followed by two or three lime-sulphur sprays and, if necessary, cover sprays of captan, thiram, dodine ("Melprex"*) or glyodin† If for any reason an infection becomes established, it is feasible to eradicate it with organic mercury compounds. Phenyl mercuric chloride (PMC) is normally used, at 0·005 per cent. Such a spray must not be used within 4 months of harvest on account of the poisonous residues left in the fruit.

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*Dodecyl guanadine acetate.

†Heptadecyl-glyoxalidine.

(If a post-harvest spray is needed, the ground should be cultivated soon after late varieties are harvested. The trees should then be sprayed very thoroughly with 0·01 per cent. PMC. Cultivation next season should be delayed as long as practicable.)

POWDERY MILDEW

Powdery mildew diseases attack large numbers of plant species, from cereal crops to garden ornamentals. The species that affects apples also attacks pears and quinces. There is considerable variation in varietal susceptibility, Jonathan and Rome Beauty being important varieties that are often attacked seriously. Gravenstein and King David are affected sometimes and even Granny Smith is involved occasionally.

Symptoms

The most obvious sign of powdery mildew is the conspicuous fungal growth on leaves and twigs but in fact most damage comes from long-term effects on tree vitality. Where the disease is not controlled, susceptible trees become stunted and quite unthrifty. If powdery mildew is serious one year, the next year's crop will be reduced due to damage to buds. Leaves, twigs, buds, blossoms and sometimes fruit are damaged.

On **leaves,** the disease shows first in spring as small white or light grey patches on the lower surfaces. The patches spread very rapidly and soon the leaf is covered with a floury powder. The leaves show mottling, are stunted and narrow, and may die. The white growth on the leaves will spread readily to the **twigs,** and several inches may be covered completely by a grey growth that darkens as the season progresses (Plate 2). Such twigs are either stunted or killed. Tips are especially liable to attack. **Buds** formed on infected twigs or in the axils of infected leaves are infected and are of importance when they open in the next spring.

The **blossoms,** as their buds open, are usually infected by fungus parts that entered the bud in the previous season. The entire flower cluster will be affected. It will shrivel and wither; no fruit will be set.

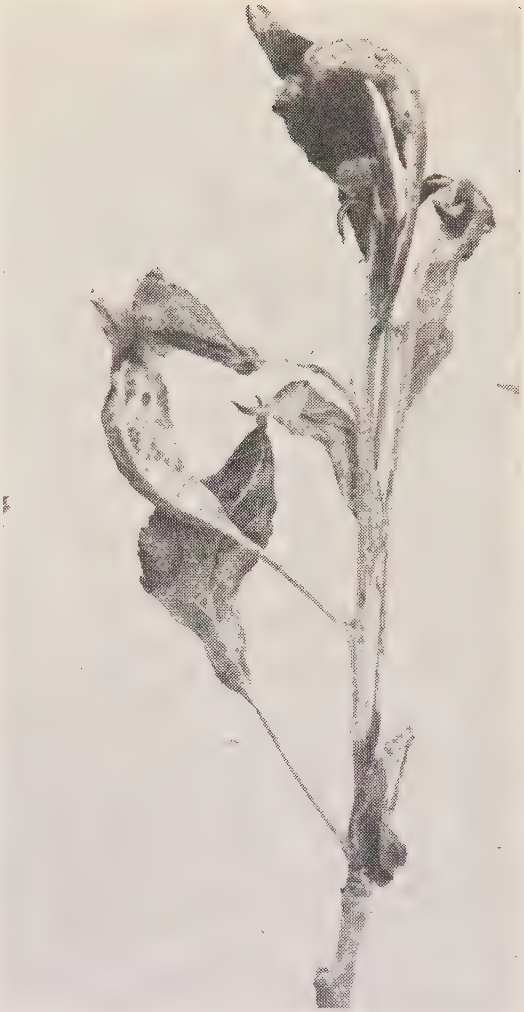

Plate 2

Powdery mildew. Note the white fungus growth on the twig and the misshapen leaves.

If **fruit** are involved, they may be stunted but usually they have only a typical russet on the skin. This is composed of a maze of very fine lines, often so close as to appear as a solid patch. Due to local hardening of the skin, the fruit may crack.

Cause

Powdery mildew is caused by a fungus, *Podosphaera leucotricha.* Unlike most other fungus parasites of plants, it lives mostly on the surface of the plant; it feeds off its host by means of special sucking organs called haustoria which penetrate a short distance into the plant cells. The life history of the fungus is important in devising control measures.

Disease Cycle

The fungus lives over winter within fruit buds and leaf buds. In spring, as the buds open, the fungus attacks first the young leaves and then, as they open, the blossoms from infected buds. It spreads rapidly on the leaves and twigs and produces vast numbers of spores. These blow about and, if they land on susceptible tissue in favourable weather, they germinate, infect the leaf or twig, produce more spores, and so on. (Favourable weather for spore germination is warm but humid, especially when the air is saturated at temperatures around 50 to 75 deg. F. Such conditions occur commonly at night in "dry" weather and powdery mildew is often worst in dry periods.) The presence of free water stops spore germination.

The fungus infections grow down petioles (leaf stalks) and twigs and into the next season's buds which are already present but not yet tightly closed; there it stays dormant, ready to restart the whole cycle in the next season. Buds are susceptible for about a month after formation. Fruit buds are formed mostly at blossom time; some, plus many leaf buds, are formed on the current season's shoots as the shoots extend. Each such bud is "open" for about a month after formation so that the total time during which susceptible buds are present lasts well into summer. Commonly, however, late-formed buds are removed in pruning so that protection for them is not so important as protection for the fruit buds and first-formed leaf buds.

Control

Controlling powdery mildew depends largely on breaking the fungus's life cycle. This is done by protecting the important buds during the period they are open, and removing any that do become infected. In addition it is possible, though the economics are doubtful except on the variety Jonathan where some fruit is set on current year's wood, to apply cover sprays to cut down twig and leaf losses. Occasionally one finds dormant sprays used against mildew; but such sprays can play no part in control because the over-wintering fungus is inside some of the buds and thus effectively protected from the fungicide.

All apparently diseased buds should be removed and destroyed during winter pruning. In addition, as many terminal buds as possible should be removed in winter provided that does not interfere unreasonably with tree management. In spring, diseased blossom trusses should be removed. Also in spring two strategically timed sprays of sulphur or "Karathane"* will reduce infection markedly. These should be at "pink" and "calyx" stages. In some places a third spray at the "fruitlet" stage may be of value. It should be noted that "Karathane" is of little value against scab, but sulphur is. Therefore if both diseases are present, sulphur should be chosen.

For cover sprays, if used, sulphur or "Karathane" can be used.

BITTER ROT

Bitter rot shows mainly late in the growing season. It is therefore potentially important in that a crop can be badly damaged after the grower has gone to the expense of producing it. Luckily it is normally not serious and it tends to be sporadic in appearance.

Symptoms

Only **fruit** symptoms have been met in Queensland. Usually the spots appear only as the fruit approaches full size. They start as small circular light brown spots but enlarge rapidly and become very slightly sunken in the centre. A common size is ½ to ¾ in. diameter but eventually the whole fruit may be involved. After the diameter of ½ in. is attained there appear on the surface tiny scattered pink or white spots (Plate 3.) Often these are arranged in rings. The rot is soft but is never distinctly mushy or leathery. All varieties may be attacked but it is seen most commonly on Granny Smith.

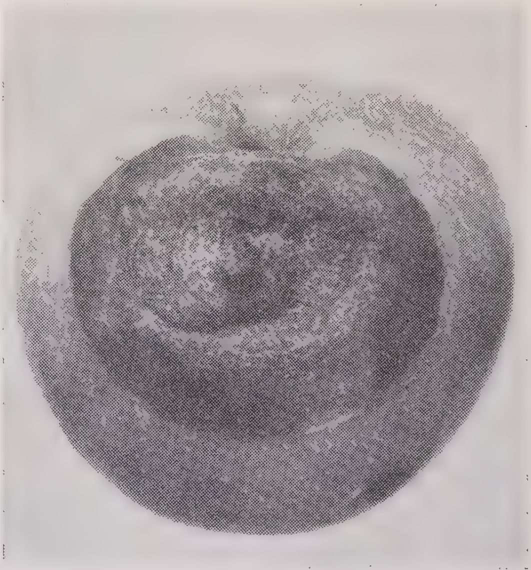

Plate 3

Bitter rot. Note the concentric rings of tiny pustules.

---

* Dinitrocapryl phenyl crotonate.

ause

In Queensland, two distinct fungi cause bitter t but the diseases they cause are so similar that r practical purposes they are treated here gether. The one with pink pustules is by far e more common and is *Glomerella cingulata.* he white flecked rot is relatively rare here and due to *Gloeosporium album.*

isease Cycle

Bitter rot fungi require rather high temperatures r rapid development. Moreover, green fruit e less susceptible to attack than ripe. Conse- uently the disease seldom shows until late in the rowing season, and a cool spell slows down the ot growth considerably.

Infection comes from fruit mummies of the revious season and from fungus parts that have ver-wintered in protected bark crevices. In arm humid conditions spores are released in bundance to infest the fruit. The fruit spots oon produce and release masses of more spores the pink and white pustules mentioned) to infect ore fruit, and so on. In warm wet weather sting for 7 to 10 days, a great number of infec- ons can occur.

ontrol

Because epidemics of bitter rot are sporadic their occurrence and because many orchards a bitter rot area may have negligible losses, et spray recommendations are virtually impos- ible. Orchard hygiene must be on the basis of ontrol. All mummied fruit and dead twigs hould be removed; fruit under trees should be emoved. During the fruit season, the first nfected fruit should be removed and destroyed efore the pink (or white) spots appear to give vastly increased source of spores. Captan prays can be used in cover sprays if necessary luring hot humid weather and will give control f sooty blotch at the same time.

Bitter rot is a warm weather disease; it does not develop in cool storage. Even apparently healthy ruit from an affected orchard must be regarded s suspect and refrigerated as soon as possible. Diseased fruit should not be stored.

SOOTY BLOTCH

In humid weather, sooty blotch may show on ripening apples, particularly on the variety Granny Smith. It is entirely superficial, the main loss coming from down-grading of the fruit.

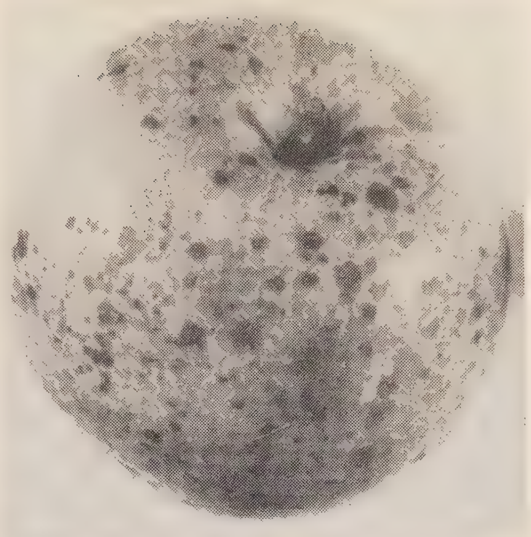

Plate 4
Sooty blotch.

Sooty blotch spots are dark grey to dull black in colour, indefinite in shape and very variable in size (Plate 4). They are purely superficial and can be removed by vigorous rubbing; a moist finger can usually remove the growth.

The disease is caused by a fungus, *Leptothyrium fuliginosum.* It needs rainy and relatively cool weather to thrive and is usually completely absent in hot dry seasons.

Control

Usually it is not worthwhile to apply special sprays. It is often found that the incidence is negligble if a full programme to control other diseases is used. Thus captan cover sprays against scab will reduce sooty blotch; zineb is slightly better against the sooty blotch but not quite so good against scab. Alternation (or combination, each at half strength) of these materials has been used successfully in some places.

ARMILLARIA ROOT ROT

Armillaria root rot is also known as mushroom root rot, honey fungus root rot, shoestring, and oak fungus root rot. It is present throughout the world. It can be regarded as a disease of native trees which will also attack orchard trees and vegetables planted in cleared ground. Its overall importance is not great but in some localised areas the problem can be formidable, especially as its presence is not suspected until after the orchard is planted.

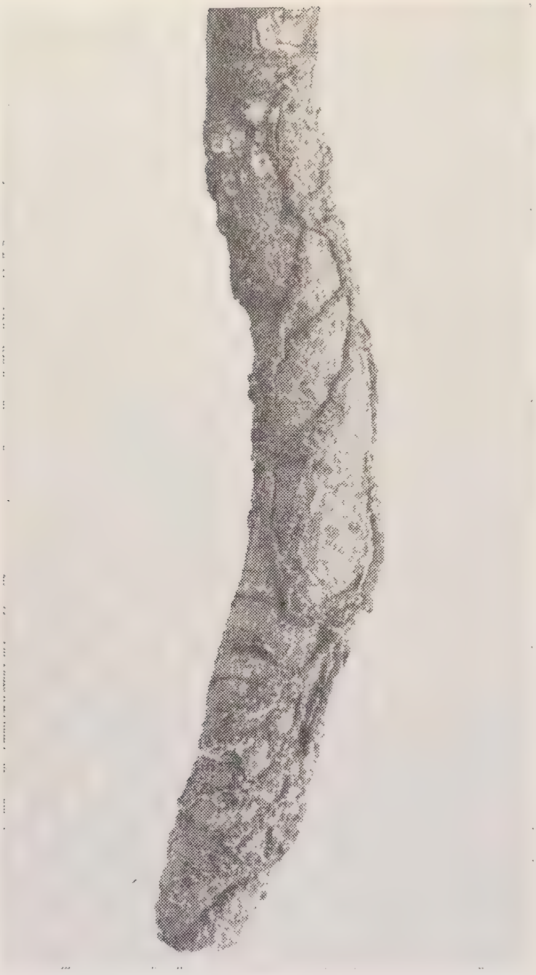

Plate 5

Armillaria root rot. Note the open web of black threads growing on this root.

Symptoms

Above ground, affected trees show wilt and weak foliage growth. Young trees will be killed outright but larger trees may have one or two limbs only affected. On larger trees one side of the trunk will have a dead, slightly wet area around ground level; there, under the bark will be found a white, fan-shaped mat of the fungus. As similar mats occur when tree death is due to other causes, its presence is not a definite indication of the disease. Diagnosis cannot be made definite without examining the roots. Some, or all, of the roots will have an open web of black threads (rhizomorphs) of the fungus growing over them (Plate 5). These are about one-sixteenth to one-eighth in. diameter, hence the name shoestring, they can easily be mistaken for dried rootlets. Sometimes clumps of the fungus fruiting bodies occur at the base of the tree. These are honey-coloured stalked mushrooms and have gills on the under surface.

Cause

The disease is due to a fungus, *Armillaria mellea*. This lives on native tree roots but transfers readily to fruit trees or vegetables planted in cleared land. It can grow out many feet from a piece of infected root to a new host.

Control

Infection from old buried roots plus the fact that symptoms do not show until infection is well established make control of Armillaria root rot difficult.

Where possible, trees should not be planted in newly cleared land. There is some indication that bull-dozed country is worse than ring-barked.

Diseased trees should be pulled out and destroyed, preferably on the spot; as many roots as possible should be included in the destruction.

If a small infection occurs on a valuable tree, the following procedure can be tried: Dig the soil away from the trunk for about 2 ft., thus exposing the main roots to sun and air. Cut away infected roots and destroy them. Cut or chisel out all infected bark. Scrape this back to healthy wood and paint the clean surface with a paste of Bordeaux mixture or a solution of dinitro-o-cresol (DNOC) in methylated spirits.

Destroyed trees should not be replaced for several years unless the soil is disinfected. To disinfect the soil, use carbon disulphide. This is injected into holes 8 to 10 in. deep and 18 in. apart, using 2 oz. (three-eighth fl. oz.) in each hole. The holes should be sealed; preferably the surface soil should be moist. This treatment kills all living trees in the treated area but does not spread far outside that area. Do not increase the dosage.

COLLAR ROT

Young plantings of apple trees are sometimes found to die. A major cause of this is collar rot.

The disease is particularly severe on old land that has been repeatedly cropped to vegetables. It appears most frequently in trees 2 to 3 years old but it has also been recorded as having attacked trees up to 14 years of age. Varieties of apples found infected in the field up to the present are Granny Smith, Lord Nelson, Delicious and Gravenstein.

mptoms

The fungus attacks the trunk at, or just below, ound level, where it produces a rot. A ominent white weft of fungal strands may be esent when the soil is moist, but a definite agnosis is made by the presence on the crown ea or in the soil nearby of the brown, round slightly irregularly shaped sclerotia or resting odies of the fungus (Plate 6). These resting odies resemble radish seed.

One side of the trunk is attacked first, and the aves on this side quickly turn a characteristic ddish or greyish-purple colour and wilt. The aves then become dry, papery and brown in olour. The fungus produces a rot of the bark nd woody tisues which gradually encircles the em, and the tree dies. Rarely, a whole tree ay show a sudden collapse.

ause

This disease is caused by a fungus, *Sclerotium olfsii*. This is of worldwide distribution and tacks a great variety of crops, including many egetables. As it is soil-borne, trees may die if lanted in ground that has recently grown a egetable crop affected by the disease.

ontrol

The history of old vegetable land regarding rown rots should be considered carefully before uch land is converted to an apple orchard.

A careful examination should be made for ne fungus on the roots of young trees before ney are planted. Infected trees should be careully removed and burnt, and the remainder ipped in Bordeaux mixture or a suspension of a roprietary copper spray before planting.

Regular examinations should be made after he trees are set out. On the appearance of ymptoms of the disease, the soil should be emoved from the crown to expose the infected rea. This area should be cut away with a sharp nife until clean, healthy tissue is revealed, when he area should be covered with a thick paste of ither Bordeaux mixture or one of the proprietary opper sprays. The soil should be kept removed rom the crown for up to 10 weeks, by which ime the area will be effectively covered with allus tissue. During this period, depending on eather conditions, it may be found necessary o renew the application of copper paste over the ut area. This method appears to be effective the disease is detected early enough—that is, efore the infection has involved a considerable rea of the trunk.

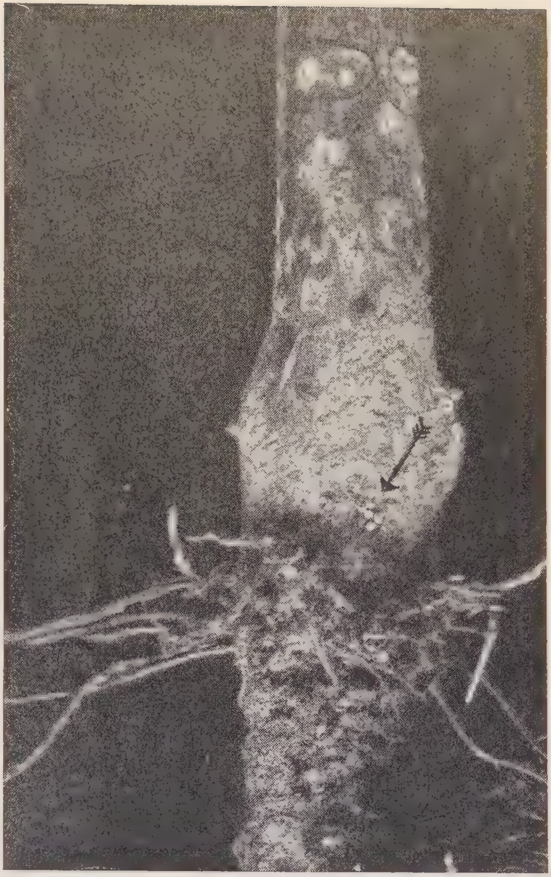

Plate 6

Collar rot. The arrow points to a group of resting bodies of the fungus.

New Zealand blue lupins should not be used as a cover crop in an infected orchard as they may assist in the multiplication and distribution of the fungus in the soil. As an alterative, rye or wheat should be sown.

CROWN GALL

Crown gall is not now considered so important as it was once feared it would be. Nevertheless growers should take steps to avoid its occurrence in orchards. The common symptom is a roughly spherical tumor or gall. This has a convoluted surface and is normally up to ½ in. diameter. Much larger galls sometimes occur (Plate 7). Galls can occur anywhere on the plant but normally they are found only on below-ground parts. There the base of the stock is a common site.

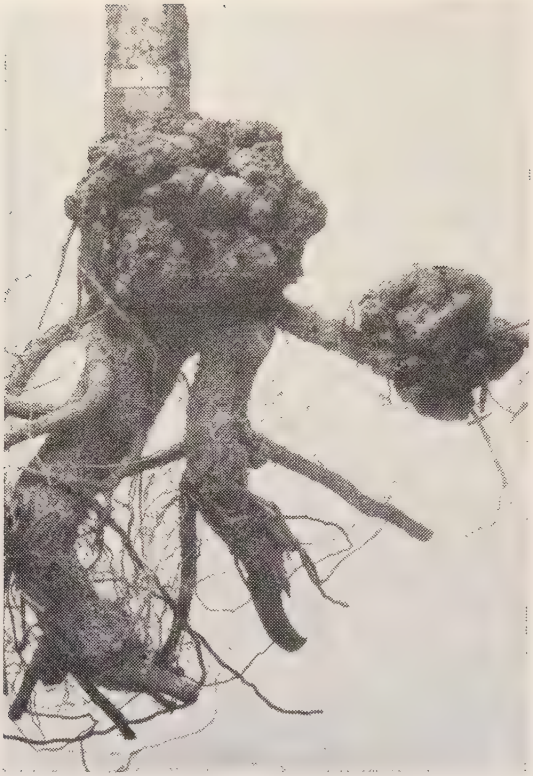

Plate 7

Crown gall.

The disease is bacterial, being caused by *Agrobacterium tumefaciens*. It is world-wide in occurrence and is soil-borne.

Control

Though it is now thought that the direct loss from galls on established trees is not of great importance, it is essential that diseased young trees be not planted. Nursery trees should be examined before planting out and any galled ones rejected.

Certain stocks are more susceptible than others. Merton 789 seems the most susceptible stock used in Queensland. Nurseries and growers who graft and bud their own trees should avoid it if crown gall occurs on their properties.

WOOD ROT (POLYSTICTUS)

If the wood of an apple tree is exposed in an way, such as by breakage or in pruning, it liable to infestation by wood rotting fungi, th most aggressive of which is *Polystictus versicolo* This, and to a lesser extent other fungi includin *Schizophyllum commune* attack the bark an wood. The bark often becomes scaly, hence th condition is sometimes called paper bark disease Beyond the point of attack the tree dies; th infection also spreads downwards. The fungu produces numerous fruiting bodies on dead wood These are brackets, roughly semi-circular.

Control

Control should aim at preventing the diseas occurring. Prunings, especially large prunings and all dead or neglected apple trees should b burnt. Large pruning cuts should be sealed wit grafting mastic.

When the disease occurs, the affected limb should be cut back well below the point o visible infection and the cut sealed.

VIRUS DISEASES

There are several virus diseases of apple which do not occur in Queensland. Here a present the only important virus disease is mosaic and orchardists should be constantly watchfu to keep others out and to reduce the incidenc of mosaic. The damage is not spectacular bu throughout the life of a fruit tree it is considerabl and more than enough to warrant precautions.

Mosaic symptoms are confined to the leaves and consist of many-sided blotches of white o yellow in the green leaves. Sometimes it i obvious on one or two branches only.

Control

Mosaic and other possibly dangerous viru diseases are spread by grafting and budding

Growers should, therefore, closely examine tree which is to be used as a source of scions No tree showing any unusual pattern in th leaves or any quantity of malformed fruit shoul be considered. As mosaic can be spread vi natural root grafts, trees next to affected one should also be passed over.

Progress In Bloat Control

By A. HUTCHINGS, Senior Adviser in Cattle Husbandry.

An easily prepared product for bloat control is now on the market. Cattle quickly take to it when it is added to a small amount of meal during the morning milking, and they have obtained freedom from bloat for the day's grazing. It rapidly emulsifies in cold water for spraying on pasture.

While no method of complete prevention of bloat has been found, the risk can be reduced considerably by techniques recommended by T. H. Rudder in Advisory leaflet No. 251 published in the *Q.A.J.*, November, 1959. These recommendations included pasture management to aim at increasing the proportion of grass to clover, feeding hay or silage prior to grazing "bloaty" pastures, strip grazing, cutting and wilting before feeding and, finally, spraying pasture with tallow emulsion.

Tallow spraying of pastures proved the most effective method for controlling bloat in grazing cows. However, without proper equipment the preparation of tallow emulsion and the pasture treatment are rather time-consuming.

A Mineral Oil Emulsion

A petroleum company has recently produced a mineral oil preparation called "Anti-Bloat" which appears to be effective in bloat prevention. Compared with tallow it has some advantages, namely—

(*a*) It rapidly emulsifies in cold water and remains emulsified for over half an hour without further stirring. Preparation for pasture spraying is thus simplified.

(*b*) Cows quickly take it in small amounts in meal and thereby obtain relative freedom from bloat during a full day's grazing on "'bloaty" pastures. Drenching or ruminal injection with 2 oz. of "Anti-Bloat" relieves bloat in 15 to 35 min. according to the severity of the bloat. At a rate of 2 oz. a cow daily, the cost is 4s. 6d. a cow monthly.

Plate 1: **A Typical Case of Bloat in a Member of the Herd Grazing Irrigated Pasture.**

Field Trial

"Anti-Bloat" has been used in a field trial over a 7 week period on the property of Mr. G. Taylor, dairy farmer, Redbank, near Ipswich. Herd production over the period increased from 167 to 185 gal. daily. Herd size ranged from 65 to 69 milkers.

Grazing consisted of 22 x 1 acre paddocks of lush irrigated pasture which contained rather more clover than grass during the time of the trial.

Cows were grazed continuously from 7.30 a.m. to 4.30 p.m. daily and were allowed a fresh paddock each day. The pasture was dense and approximately 10 in. high when grazed by the herd. Cows were able to eat freely, with quite an amount of grazing still available at the end of the day. At night they were enclosed in a paddock near the milking shed and given free access to lucerne hay provided in wooden racks.

Method of Use

As Mr. Taylor regularly feeds a small amount of meal during milking, it was found convenient to add “Anti-Bloat” to the meal each morning. The 2 oz. of “Anti-Bloat” were added to about 4 oz. of water and then poured over the meal in front of each cow. The meal quickly absorbed the oil emulsion and only a few cows hesitated to eat the meal on the first occasion. Within a few days each cow received the oil according to plan.

On July 21, the day preceding initial treatment, five cows bloated. At 10.45 a.m. the next day three bloat-susceptible cows were grazed in a fresh lush pasture after two of them had been drenched with 2 oz. of “Anti-Bloat” in 4 oz. of water. All three grazed contentedly until 2.30 p.m., when the control cow became bloated and was relieved by drenching with 2 oz. of “Anti-Bloat” in 4 oz. of water. The two treated cows continued grazing intermittently until brought in for milking at 4.30 p.m.

The remaining 62 head were not given “Anti-Bloat” and were grazed in an adjacent paddock. The first cow bloated at midday and during the afternoon seven more bloated. Six of these were treated experimentally as follows:

(*a*) 1 was drenched with 2 oz. “Anti-Bloat” (making a total of two treated in this manner on that day).

(*b*) 2 were given a ruminal injection of 2 oz. “Anti-Bloat.”

(*c*) 2 were given both treatments (*a*) and (*b*).

(*d*) 1 was drenched with 2 oz. “Anti-Bloat” plus a bottle of another proprietary preparation.

In these few cases, relief was not accelerated by the double treatments in (*c*) and (*d*). Bloat was relieved in 15 to 35 min., the more severe cases taking the longer time. This indicated tha drenching with 2 oz. of “Anti-Bloat” satisfactoril relieves bloated cows.

Commencing on July 23, and continuing unti August 2, eight cows were given “Anti-Bloat” daily at different rates in their morning mea while the remaining 57 cows were not treate (control group). During this time seven cow in the control group bloated and several mor also in the control group were “full” but did no show further discomfort. Six cows needed relie and were drenched.

Commencing on August 3, from 56 to 64 cow were given “Anti-Bloat” daily in their mornin meal while four or five cows which had previousl bloated were held as controls. This continue until August 31, during which time three case of bloat occurred and required drenching. Thes three cases were in the treated group and n satisfactory explanation can be given for this. N control animals suffered from bloat in this period.

As it was thought that bloat was easing off “Anti-Bloat” treatment was discontinued. Bu during the first four days of September, eigh cases of bloat occurred and all required treatment

Commencing on September 5, seven cows wer held as controls while the remaining 61 were fe “Anti-Bloat” in their morning meal. On September 8, four control cows bloated but were remove from grazing before drenching was necessary. O September 12, two control cows bloated and bot required a relief drench. From September 1 onwards all cows have been given “Anti-Bloat in their morning meal and no further measure for bloat control have been required to the en of the first week in October.

Feeding of “Anti-Bloat” was continued unti mid-November when it was thought that th bloat season would be over. But a total of nin cows bloated on the two days following th cessation of feeding “Anti-Bloat.” This indicate that the pastures were still capable of causin bloat, but the disorder was being kept in chec by treatment with the bloat-preventing preparation.

The trial indicated that this mineral oil preparation is relatively effective in preventing bloa and that it can be used in a small amount o meal fed before grazing commences. It is equall effective in relieving bloat when administered a a drench or by intrarumenal injection.

asture Spraying

Although "Anti-Bloat" emulsion was not rayed on pasture in this trial, it should be ually effective when used in this manner. As can be added to only small quantities of water, raying with a knapsack may prove satisfactory r small areas.

Subsequent observations have shown that asture spraying with both knapsack and power rays gives equally good results.

urther Suggestions

Keeping in mind that bloated cows should not driven fast, it is suggested that a simply con-ructed yard or bails, together with equipment r treating cases of bloat, be provided near lush astures.

A degree of control may be achieved by supplying hay in a raised rack in or near the pastures.

It is suggested that animals known to be susceptible to bloat be given an extra ounce of oil in their feed or as a drench.

Mr. Taylor uses field binoculars for closer observation when he is not near grazing cattle. In this way, travelling and stock could be saved. Frequent observation is always necessary.

Acknowledgement

Due recognition is hereby offered to Mr. C. Taylor for his wholehearted co-operation and to Mr. M. L. Noume, Industrial Chemist, who was closely associated with the field trials.

❧

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Nematode Root - Rot Of Bananas

By R. C. COLBRAN,
Research Entomologist,

And

G. W. SAUNDERS,
Entomologist.

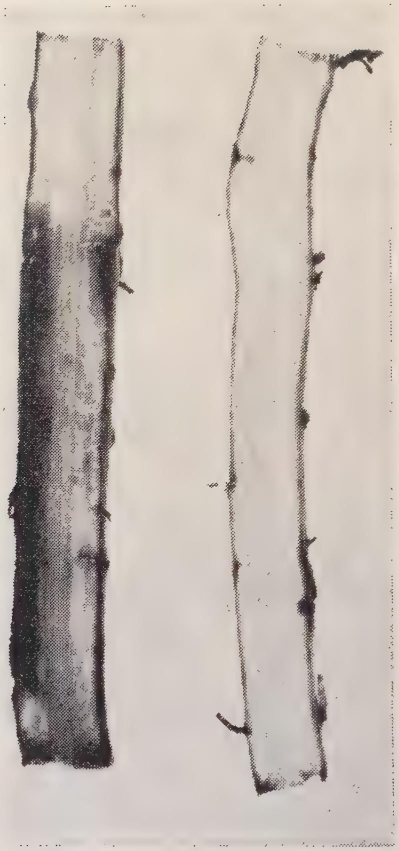

Plate 1
Longitudinal Sections of 2 Banana Roots. Left, infested with burrowing nematodes; right, normal.

The burrowing nematode is responsible for a serious root-rot of bananas in Queensland. The life history, behaviour and control of this pest are described.

In 1917, a rot of banana roots due to the burrowing nematode was reported for the first time in Queensland. The report came from the Cairns district. This pest has since been found in all banana-growing areas of the State.

In addition to the burrowing nematode, several other nematodes are responsible for banana root injury in Queensland. Spiral nematodes feed on the outer cells of healthy roots, producing surface necroses or areas of dead tissue; root-knot nematodes cause the formation of root galls; and root-lesion nematodes produce a rot similar to that caused by the burrowing nematode.

Life History of the Burrowing Nematode

The burrowing nematode feeds and reproduces within the root cortex, or outer sheath. Feeding is by means of a hollow stylet or "spear" which is forced through the cell wall and the contents of the cell are sucked out.

The death of the affected tissue is followed by hanges in colour from the normal white hrough yellow, bright red, to black. These hanges are hastened by the inevitable entry of ther soil organisms, such as fungi and bacteria, nto the damaged tissue.

The activities of successive nematode generaions lead to the formation of extensive areas of otted tissue within the cortex; the central ascular tissue is not invaded and remains white n colour until girdled by dead tissue.

This is followed by the death of the terminal ortion of the root.

The rot may extend back into the outer inch f the corm.

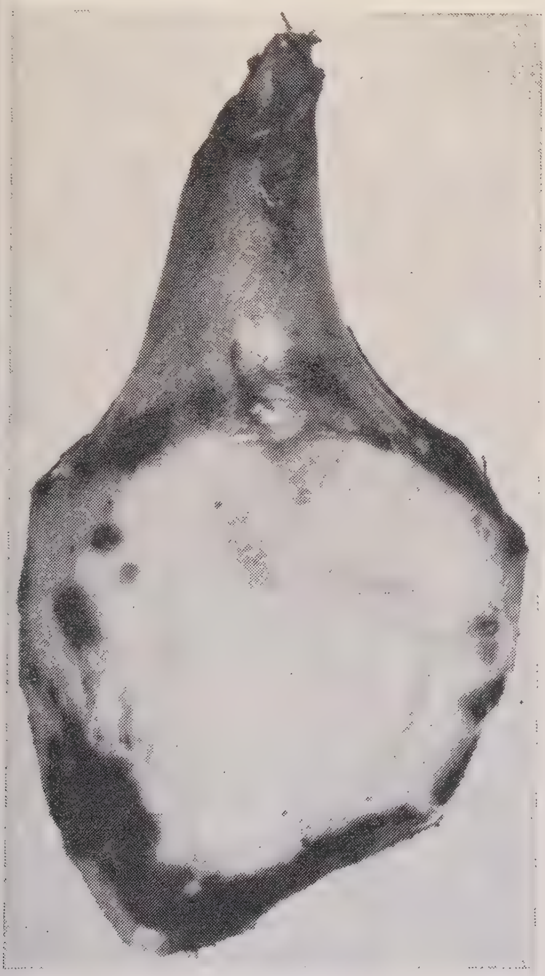

Plate 2

A Banana Sucker Infested with Burrowing Nematodes. This type of material should not be used for planting.

The majority of actively moving nematodes occur in the reddened tissue adjacent to the edge of the advancing lesion or injury. The females lay eggs in cavities within the infested root and these eggs soon hatch to produce larvae which move into the adjacent healthy tissue or if the root is badly rotted, through the soil to attack other roots. Cord roots are entered within a few inches of the tip, the entry points being marked by the formation of distinct linear lesions one-eighth to one-quarter of an inch in length.

Larvae develop by a series of moults into males or females. The males are incapable of feeding and their sole function is concerned with reproduction.

Plant Damage

The rotting of the roots causes the stool to become unthrifty and the size of the bunch and individual fruits is reduced. Frequently the bunch becomes "choked" in the heart of the plant. In wet or windy weather, stools may fall due to poor anchorage in the ground.

These symptoms may not be evident in the plant crop but they become increasingly apparent in the ratoon crops.

In North Queensland, the life of a plantation rarely exceeds 3 years, due mainly to root-rot depredation.

No commercial variety is resistant to the burrowing nematode.

Recognition of Nematode Root-Rot

Nematode root-rot is characterised by rapid death of the fibrous roots, lesions or damaged areas on the outside of the cord roots, extensive rotting of the cortex preceding discoloration of the vascular tissue, and the presence of burrowing nematodes in the infested roots and surrounding soil.

When nematode root-rot is suspected, samples of roots and surrounding soil should be forwarded to the Department of Agriculture and Stock, either in Brisbane or the nearest country centre.

Control

The burrowing nematode is spread by planting infested bits and suckers: hence the importance of obtaining planting material from root-rot-free stools. If a small amount of root-rot is present, pare the planting material free of discoloured tissue and treat in hot water at 53 to 55 deg. C. (127 to 131 deg. F.) for 20 min. before planting. In north Queensland, hot water treatment of all planting material is recommended.

Plate 3

A Banana Root with Nematode Lesions. Each lesion marks a site where burrowing nematodes have entered the root from the soil.

Planting material may be treated satisfactorily in 44 gal. drums cut transversely in half. About 25 bits or suckers, averaging 2 to 3 lb. in weight, enclosed in an open-weave hessian or string bag, can conveniently be treated in 18 to 20 gal. of water. Maintaining constant water temperature is important and not difficult. Following treatment, place the planting material in a single layer to dry.

The practice of hot-water treatment, readily incorporated in the farm programme, is becoming popular with growers in north Queensland and no adverse effect on subsequent plant growth has been reported. This treatment will also control other nematodes in the planting material as well as the burrowing nematode.

Established growers, in order to ensure a source of clean planting material, are advised to plant root-rot-free material in soil where bananas have not been grown.

Nematode populations around infested stools and in soil prior to planting can be reduced by the use of certain soil fumigants, but the economics of such treatment in Queensland have not yet been established. When a planting is badly affected with nematode root-rot, the stools should be dug out and broken up to hasten decay of infested tissues. The land should not be replanted with bananas for several years.

Scientific Names of Pests

Spiral nematodes	*Scutellonema brachyurum* (Steiner) *Helicotylenchus multicinctus* (Cobb) *Helicotylenchus nannus* (Steiner)
Root-knot nematode	*Meloidogyne javanica* (Treub)
Banana root-lesion nematode	*Pratylenchus coffeae* (Zimmerman) syn. *Pratylenchus musicola* (Cobb)
Burrowing nematode	*Radopholus similis* (Cobb)

* * *

FARM SAFETY

Familiarity can breed contempt, but when you are dealing with bulls you should be careful at all times.

Accidents, some of them fatal, happen every year because stockmen and farmers fail to treat their bulls with respect.

Keep your eye on the bull!

Treating Sheep For Lungworm

y A. T. BELL, Director of Sheep Husbandry,
nd R. B. YOUNG, Senior Adviser in Sheep and Wool.

Two new drugs are effective against lungworm in sheep, but improved feeding is still recommended as a means of limiting infection by these parasites.

The large lungworm, *Dictyocaulus filaria,* although a sheep parasite with a world-wide distribution, exists in sheep flocks in Queensland only within a limited geographical range. Other pecies of lungworms occupy a minor place in nfections.

It is confined mainly to cold areas with a fairly high altitude and high winter rainfall, such as tanthorpe, Goondiwindi, Inglewood, Texas, and Warwick. It has been observed in odd instances n Central Queensland. With easier sheep transportation of present times, it is possible for drafts f sheep suffering lungworm infestation to be present in sheep areas where lungworm is not normally found. In such areas they affect the heep carrying them, but the free living stage is ess likely to survive and spread the infection.

Can Be Serious Parasite

In the south-eastern Queensland areas referred o, lungworm, particularly when associated with concurrent infestations of gastro-intestinal worms uch as barber's pole, *Haemonchus contortus,* nd hairworm, *Trichostrongylus spp.,* can be a erious sheep parasite, causing severe debilitation, nd sometimes death.

Lungworm disease occurs with seasonal peaks, eing most frequent in winter and early spring. At these times poor pastures and infestations with ther worms lessen the sheep's ability to withtand lungworm infestations. Supplementary eeding can do much to limit outbreaks of lungworm disease, or restore the ability of the sheep o handle lungworms and gastro-intestinal worms ollowing treatments.

There is some suggestion that crossbreds are more subject to lungworm disease than merinos, but here the issue may be clouded by the fact that more crossbreds are run than merinos on the type of country in which the climatic environment suits lungworm survival. Severe infestations are frequently found in merinos. Young sheep are more susceptible than older age groups. This is probably due to the resistance gained by older sheep as they become subjected to successive infestations.

Plate 1
Lungworms and Lung of A Sheep.

How To Recognize Symptoms

Affected sheep cough, sneeze, and are subject to "snotty nose." Lambs may show coughing in 16 days after infection. Strong harsh coughing can signify light infections, whereas frequently in heavy infections coughing can be soft. Rapid shallow respirations and difficult breathing are important symptoms. Sheep become weak and listless, condition loss is rapid, and death of the severely emaciated animal can occur two months or so after infection. Diarrhoea has been defined as a symptom, but this may be due to confusion with concurrent hairworm symptoms. Driving or yarding, because of hastened respiration, and the presence of dust, will often enhance the amount of coughing in a mob. Bronchitis and pneumonia frequently occur as secondary infections, and coughing is a prominent symptom of both these diseases. Faecal tests do not always give satisfactory indications of the severity of infections.

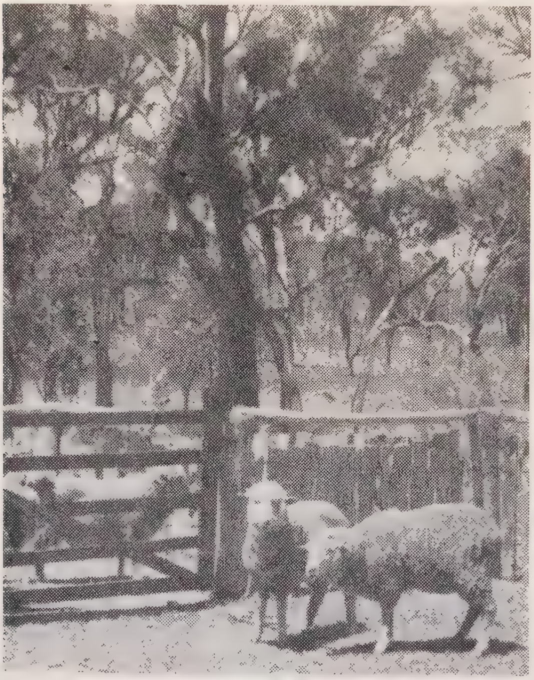

Plate 2

The Sheep In Front Is Coughing and Thereby Displaying One of the Symptoms of Lungworm Infection.

Post-mortem Examination

Adult lungworms, thin white threadlike worms up to 4 in. long are easily visible to the naked eye on opening up the air passages of the lungs of an affected sheep. Red areas of collapsed lung tissue can be found in sheep that have suffered severe infestations. The presence of these lung lesions in determining the seriousness of the infestation is probably more important than the number of worms found. Infection with less than 50 worms may be considered unimportant, since such numbers are frequently present in reasonably healthy sheep. Post-mortem examinations relative to lungworms should always include examination of the bowel portions, for possible concurrent infestations with barber's pole, hair, and nodule worms. These, more so than lungworms, may frequently be the primary cause of death.

How Does Lungworm Get There?

(*a*) Life Cycle: The infective larvae developed under moist, cold conditions are ingested by sheep during grazing or drinking. Following ingestion the larvae burrow into the intestine walls and reach the lymph vessels which carry them to the heart. Carried on in the blood to the lungs they pass through the minute blood vessels into the air passages. Adult male and female lungworms are developed in the lungs 18 days after infection. Eggs can be produced within a minimum period of 26 days, but more commonly about 5 weeks. Prenatal infection of lambs can occur through the foetal circulation. Irritation of the bronchi and broncheoles causes the sheep to cough and sneeze. Plugs of mucus containing eggs are coughed up and swallowed. The eggs hatch in the intestines and living larvae are excreted with the droppings. On occasion eggs are sneezed out on to the ground in the mucus coughed up.

(*b*) Climatic Conditions Favourable For Survival: Continuous low temperatures slow up the development of larvae, but conserve their vitality and prolong their survival. Free living stages (on the ground, outside the sheep) are favoured by moderately cold conditions, but are relatively sensitive to heat. Infestations reach peak levels in wet winters.

Infective larvae require moisture for development and at a temperature of about 64 to 74 deg. F. reach the infective stage in 6 to 7 days. They can withstand moderately dry conditions only for a few days, but are able to live in moist conditions for several months. They are able to develop at temperatures continuously as low as 41 deg. and remain healthy and more active at such temperatures than at higher ones.

Plate 3

Typical Lungworm Country in the Warwick District.

Treatment

Earlier treatments used were many and varied. Methods suggested were intratracheal injections, or inhalation methods, or nasal injections. Such materials as iodine, creosote, chloroform, turpentine, or pyrethrin were suggested for injection; sulphur fumes for inhalation. Chloroform was tried for nasal injection. All these methods called for skilled operation because they were difficult to administer, and carried a fair degree of danger to the sheep. Their effectiveness was variable, and they achieved little popularity in field use. Earlier control lay mainly in attacking the problem through improved nutrition, and this is still very important.

Two new drugs, cyanacethydrazide and diethylcarbamazine citrate, have recently been shown to have useful efficacy against this lung worm.

These drugs can be given as a drench.

Drenching for Other Worms

It should be appreciated that gastro-intestinal worms such as barber's pole, hairworm, and nodule worm, may in fact be the main cause of the sheep's diseased state, and that lungworm disease may be only an added burden. In general, it is advisable to treat for these worms primarily, by giving a phenothiazine drench at the same time as the drench for lungworm.

Because bronchitis and pneumonia often are brought on by chronic lungworm infection, sheep may take time to recover following treatment. Care is neded to put sheep into uncontaminated pastures following drenching, and to provide a high plane of nutrition.

Common Weeds of Farm and Pasture

by S. L. Everist, B.Sc., Government Botanist

A handbook that contains brief descriptions of about 110 of the common weeds of Queensland with notes on their distribution and control.

Price to Queensland farmers	5s.
To others	7s. 6d.

Available from Department of Agriculture and Stock, Brisbane.

ACCREDITED PULLORUM-TESTED FLOCK SCHEME

Flocks are graded into two classifications. Class 1, *Pullorum Free*—where no reactors are found at the annual test in the year in which an application is made, as well as in the preceding year, *or* where no reactors are found at each of two consecutive tests carried out at an interval of not less than 6 months. A pullorum-free flock shall be classified as such until positive reactors are found at the annual test. Class 2, *Pullorum Clean*—where the number of positive reactors detected at the annual test does not exceed 0.5 per cent.

Name and Address	Hatchery	Supplying hatching eggs	*Breeds rested for supply of fertile eggs or day-old chickens
Class 1. (*Pullorum Free*)—			
Badcock, W. S., Finucane Rd., Capalaba	+	..	AO. WL. NH.
Basnett, A. H. and A. B., 31 Duncan Street, Wynnum West	..	+	AO. WL.
Bone, C. and N. V., Rochedale Road, Rochedale	+	..	AO. WL.
Careclas, C., North Street, Wilsonton, Toowoomba	..	+	AO. WL. NH.
Conroy, V. P., Burton, via Biddeston	+	+	AO. WL.
Klein, K. and B., Biddeston	..	+	WL. NH.
Knopke, R. J., Anderson Street, Cairns	+	..	W.L. AO. NH.
Lawrence, L. C. and B. J., 40 Hursley Road, Toowoomba	..	+	WL. AO. NH.
Maxfield, F., Rowbotham Street, Toowoomba	+	..	WL. AO.
Mengel, A. E., 181 Campbell Street, Toowoomba	+	..	NH.
Mengel, C. J., 50 New Lindum Road, Wynnum West	+	..	AO.
Moss, C. L., Moss Road, Manly	+	..	AO. WL.
Shale, W. R. C., 55 Tingalpa Road, Hemmant	+	+	AO. WL.
Sherrie, G., M/S 1497, South Street, West Toowoomba	+	..	AO.
Skett, E. E., Hoepper Street, Toowoomba	..	+	AO. WL.
Weaver, G. A. C., Carbeen (Box 240, Atherton)	+	..	AO. WL. BrL.
Class 2. (*Pullorum Clean*)—			
Armitstead, J. H. L. and C., Dragon Street South, Warwick	+	..	AO. WL.
Bowtell, C. W., 4 Payne Street, Toowoomba	+	..	AO. WL.
Bowtell, J., North Street, Wilsonton, Toowoomba	+	..	AO. WL. RIR.
Campbell, M. and Sons, Albany Creek Road, Aspley	+	..	AO. WL.
Chapman, E. M., Ipswich Road, Oxley	+	..	AO. WL. LS. NH.
Corbett, R. B., Woombye	+	..	AO. WL.
Dearling, V. R., 63 Holberton Street, Toowoomba	..	+	AO. WL.
Dobson, J. A., Morayfield	..	+	AO. WL.
Downs Hatchery, 4 Thorn Street, Toowoomba	+	..	AO. WL. NH.
Gamble, N. C., Biddeston	..	+	AO. WL. NH.
Gisler Bros., Wynnum Road, Wynnum	+	..	AO. WL. M.
Gray, A. H. and S., New Cleveland Road, Gumdale	+	..	AO. WL.
Hoopert, A. E., 24 Greenwattle Street, Toowoomba	+	..	AO. WL. RIR.
Jamieson, J. A., 84 Randall Road, Wynnum West	+	..	AO. WL.
Kirkby, K. S., New Cleveland Road, Tingalpa	+	..	AO. WL.
Lax, G., Redland Bay Road, Pinklands, Cleveland	+	..	AO. WL.
Lindsay, P. J., Morayfield	..	+	AO. WL.
Lindsay and Dobson, Morayfield	..	+	AO. WL.
Lister, E. B. and E. M., 25 Haig Street, Toowoomba	+	..	AO. WL. NH.
Lingard, S. and R. I., Mons Road, Buderim	+	..	AO. WL.
Loveday, G. C., " Attinga," Peachester	+	..	AO. WL.
Millar, K. F., " Bengelima," Box 23, Caboolture	+	..	AO. WL.
Moore, W., Broadwater Road, Mount Gravatt	+	+	AO. WL.
Moffatt, A. K., 337 Redlands Road, Upper Mount Gravatt	+	..	AO. WL.
O'Sullivan, J. V., Glen Road, Warwick	..	+	AO. WL.
Perkins, W. J., 307 Hume Street, South Toowoomba	+	..	AO. WL. NH.
Queensland Agricultural High School and College, Lawes	..	+	Various
Rumball, I. and J., Messines Ridge Road, Holland Park, Brisbane	+	..	AO. WL.
Slaughter, R. E. and M. H., 858 Beams Road, Aspley	+	+	AO. WL.
Thorpe, H. G., 24 Augstein Street, Coopers Plains	+	..	WL. RIR.
Tesch, E. R., Waterford	..	+	WL. RIR.
Warman, W. A., D'Aguilar	..	+	AO. WL.
Winwood, G., Old Cleveland Road, Belmont	+	..	AO. WL.
Willis, M. and N., Top Camp Road, Hodgsonvale	..	+	AO. WL.

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* Breeds (abbreviations) A.O. = Australorps, BrL. = Brown Leghorn, L.S. = Light Sussex, M = " Meat type " breeds, N.H. = New Hampshire, R.I.R. = Rhode Island Red, W.L. = White Leghorn.

Plate 1
A Colour-Strap Banded Black Swan, *C. atratus* **(Latham)**
Caley Valley, April, 1960.

Colour-Strap Banding Of Black Swans

By H. J. LAVERY, Entomologist.

As part of a programme of waterfowl conservation in Queensland, a number of birds are banded to determine migratory habits. Banded game birds which are shot and handled are identified by a small aluminium band on the leg (Plate 2). For the non-game birds, some other form of recognition must be used.

Black swans, *Cygnus atratus* (Latham), breed commonly on the Caley Valley waterfowl management area near Bowen, where research is being carried out into their feeding, breeding, migratory and other habits. To observe the movements of recent hatches of the swan population, a visual method of recovery is used. Brightly coloured markers, harmless to the bird, durable, and easily visible at a distance by the unaided eye, are placed on young birds, and the birds' subsequent movements traced from sighting reports.

Following the breeding season each year, family groups of cygnets are collected; each bird is weighed, sexed and a coloured vinyl-plastic strap is fastened around the neck (Plates 1 and 3).

To provide for a marker being found detached or on a dead body, an aluminium band is attached to the strap. The straps are of such size that when fastened around the necks of cygnets over 10 oz. in weight they will not affect later normal adult feeding habits. Colours are selected according

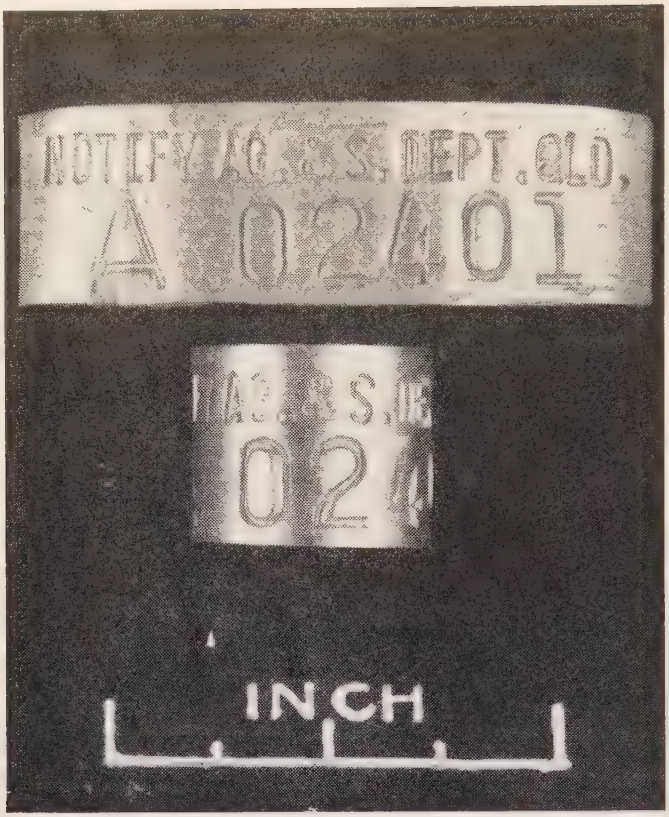

Plate 2

Aluminium Duck Bands as Used by the Queensland Department of Agriculture and Stock.

to the sex of the bird and the year of banding, and those used to date are:

1959—Male, red; female, green.

1960—Male, blue; female, yellow.

Thus a swan with a blue strap around its neck represents one of a group hatched and banded at Caley Valley near Bowen, North Queensland, in the 1960 post-breeding season.

Several reports of the 1959 hatch have been made and it is expected that more will follow as further hatches are banded. These will determine not only individual migration, dispersion and seasonal movements, but also homing ability, death rate and length of life, population size and structure, constancy of mate and location, and a wide range of habits generally.

The success of this project depends upon the report of sightings of these marked birds. When reporting, an observer should note where the swan was seen, when, the colour of the strap and any notable features.

Reports should be forwarded to the Fauna Officer, Department of Agriculture and Stock, Brisbane, Queensland. When a strap itself is found, its return would be appreciated.

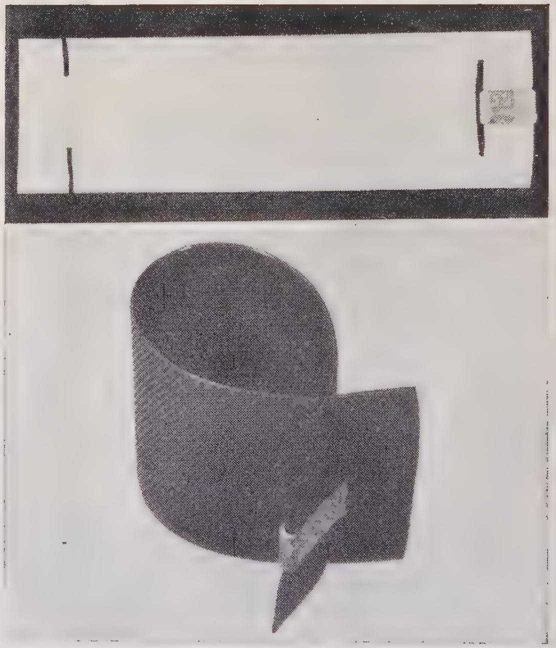

Plate 3

A Colour-Strap Band (top) Unfastened, (bottom) Fastened.

Sod-Seeding Irrigated Pastures And Lucerne

By C. A. SCHRODER, Regional Experiment Stations Branch.

As a result of extensive research carried out at the Department's Regional Experiment Station at Gatton, advice is given on the sod-seeding of irrigated pastures and lucerne. It is shown, in one instance, that when white clover was sod-seeded into a grass pasture, it multiplied yield from that area by three.

Sod-seeding is a practice which can be used with advantage on irrigated farms.

It is a simple and reliable method of introducing new species, or of increasing the amount of some already present. The cost is low and little interference is caused to the pasture treated.

Grazing may be reduced for a short period after sod-seeding but benefits quickly follow this operation.

The practice has a wide application and although sod-seeding is not a complete substitute for ploughing and routine soil preparation, there are many instances where it can profitably be used as a major means of pasture improvement.

Scope for Sod-seeding

Under irrigation at the Gatton Regional Experiment Station, Wimmera, Italian and H1 rye-grasses, prairie grass, paspalum, Rhodes grass and winter cereals such as oats, can all be established without difficulty into existing swards of white clover. White clover can be successfully established into existing stands of grasses including paspalum, Rhodes, rye, phalaris and cocksfoot, while oats for grazing can be established in paspalum/white clover pasture or in old lucerne stands that have thinned out. Some difficulties have been experienced in establishing cocksfoot and phalaris in existing white clover.

Limitations

Success in sod-seeding is limited to the use of those species which are capable of germinating in a partially prepared seed-bed in the existing green cover or stubble. They must also be capable of fast early growth so as to establish in competition with the existing species.

Investigations have been restricted to sod-seeding during the autumn months, because competition from strongly growing weeds and summer species would limit establishment of new species in the summer period.

Sod-seeding of white clover into dense stands of paspalum, mat grass or couch grass in the coastal areas may require more complete initial soil preparation. Similarly application of fertilizer would assist early development of the sod-seeded species.

Advantages

(*a*) In some soils the initial level of fertility is too low to support good growth of grass. After one or two years under grazed irrigated white clover, the fertility can be expected to improve to the point where good grass production is possible. The increase in the fertility of poor soils may be accelerated by fertilizer applications.

When the clover has been growing well for 12 months, a grass (selected according to the season and the purpose for which it is required) can then be introduced by sod-seeding (see Plate 1).

With appropriate irrigation and grazing management, a well-balanced grass/legume pasture can then be developed and maintained.

Plate 1

An Almost Pure Stand of Ladino White Clover which would Give a More Balanced Pasture by Introduction of a Grass Species.

(*b*) It sometimes happens that the grass may decline in mixture and the clover will develop until it dominates the whole pasture. This is very common in new and poorly managed areas.

In these cases a desirable grass/clover combination can be simply and successfully re-established by sod-seeding of the appropriate grass species.

(*c*) Grasses such as H1 and Italian ryegrasses make extremely fast winter growth and they have very high grazing value. They are very suitable for sod-seeding into vigorous growing white clover and if introduced early in autumn they will supply excellent grazing during the May to October period when conditions are normally poor for animal production.

(*d*) Oats or cereal rye may also be introduced into pastures predominantly of clover. The sod-seeding should be done before mid-April.

Oats can also be successfully introduced into old stands of irrigated lucerne that have thinned out, to obtain greater fodder production in winter and spring, and to reduce the risks of bloat in animals. Applications of a nitrogenous fertilizer will stimulate oat production. In Queensland, worthwhile results are not obtained in dense stands of lucerne as in these conditions the oats can seldom compete with the lucerne.

(*e*) Desirable strains of white clover can be sod-seeded into existing grass swards to increase the total yield of pasture and to improve the quality and palatability of the grasses.

(*f*) Oats can be successfully sod-seeded into irrigated paspalum/white clover pastures in cool localities where paspalum becomes dormant early in autumn. However, heavy seeding rates and 4 to 8 cwt. of sulphate of ammonia to the acre are essential.

The economics of the proposition must be watched carefully when introducing a non-legume such as oats into a pasture that is already grass dominant. It is detrimental to suppress white clover by paspalum in summer and by oats in winter and spring.

Trial Results

Data from various experiments showed that sod-seeding can materially improve pastures and assist in supplying the feed requirement for livestock over important seasons of the year.

(i.) An area sown to irrigation strain white clover in May, 1953, was sod-seeded to H1 rye-grass at 7½ lb. to the acre in early April, 1955. The yields and botanical composition of this pasture were determined at each period of grazing during the ensuing year.

Date Grazing Commenced	Percentage White Clover	Percentage H1 Rye-grass	Green Yield Tons per acre
4th April, 1955	..	..	Sod seeded after grazing
26th April, 1955	100	Trace	4·80
13th May, 1955	67	33	4·20
29th June, 1955	58	42	5·20
6th September, 1955 ..	53	47	7·40
1st November, 1955 ..	40	60	8·09
6th December, 1955 ..	50	50	4·10
16th January, 1956	55	45	3·26
24th February, 1956 ..	60	40	4·20
4th April, 1956	60	40	4·90
Average	60·3	39·7	5·13
Total green yield 4th April, 1955 to 4th April, 1956			46·15
Average weekly green growth rate			·88

It has been found that H1 rye-grass which has persisted for 1 year will continue to maintain good production for up to 4 years, under careful management.

(ii.) In April, 1956, two adjacent pastures were sown (A) to white clover, H1 rye-grass and phalaris and (B) to H1 rye-grass and phalaris alone.

In the following period of 403 days, pasture (A) yielded 49 tons to the acre whereas (B) which lacked white clover produced only 13 tons to the acre.

White clover was sod-seeded into pasture (B) in the autumn of 1957 and despite competition from the grasses it was well established by the end of the year.

In the following period of 367 days, pasture (A) continued to yield well (35 tons to the acre) and the sod-seeded pasture (B) increased production to 39 tons to the acre. Both areas were providing high quality grazing.

(iii.) In an area sown in July, 1956, to ladino white clover and temperate grasses, the grasses quickly diminished and for the two years before April 1959 the pasture was virtually a pure stand of ladino clover.

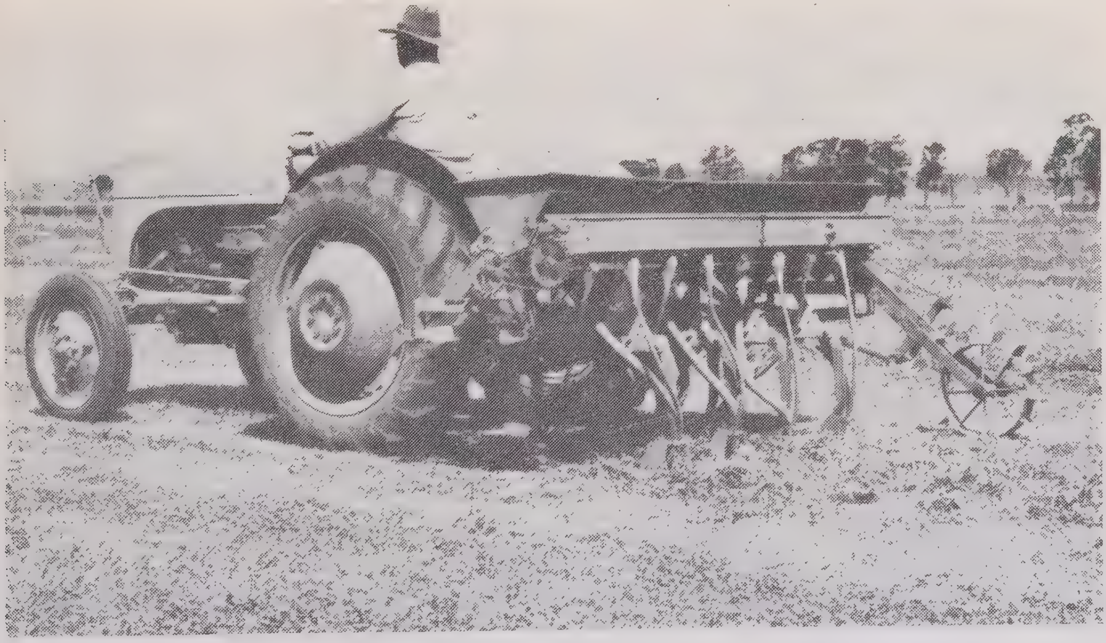

Plate 2

A Typical Sod-Seeder Ready for Operation in the Checked Ladino Clover Pasture.

Plate 3

Sod-Seeding H1 Rye-Grass into the Checked Clover Pasture on April 15, 1959.

Soil fertility had increased under the clover influence, and H1 rye-grass sod-seeded in April, 1959, provided an excellent mixed pasture for grazing from early June onwards. The supply of feed increased during July, August and September due to the production of grass, and the weekly growth rate in September averaged 1·5 tons to the acre of green material. (See Plates 1, 4 and 5).

In the improved environment the grass was able to develop rapidly into large-sized plants; it persisted well, and the pasture was still maintaining high production with a very desirable clover/grass ratio in spring, 1960.

Sod-seeding Machines

Sod-seeders are designed to plant at controlled depths into existing stubble or sward, and to handle seed ranging in size from fine clover to the larger cereals. Practically all makes will seed and fertilize in one operation. Although they function similarly to a wheat drill, differences exist in the design of the discs, boots, or notched coulters employed to open up the existing pasture sward.

Under certain conditions an ordinary seed drill can often be used satisfactorily for sod-seeding and, similarly, most makes of sod-seeders will handle all of the seed sowing requirements on a medium-sized farm.

Points to Successful Sod-seeding

Experience is necessary in sod-seeding which cannot be regarded as a simple haphazard operation.

Before seeding, it is necessary to consider selection of species, time of sowing, land preparation, setting of the machine and subsequent management methods to be employed.

(i.) *Choice of Species.*—The introduced species should be capable of germinating and establishing well in the particular environment. It must be suitable for the particular purpose required and be capable of production at the time when extra pasture is needed.

(ii.) *Time of sod-seeding*—The new species should be introduced at the time when it will develop fastest. This will ensure vigorous establishment and high production.

Sod-seeding is more successful if the existing sward is in a relatively dormant stage or if vigour is temporarily checked by preparatory treatment.

The operation should be timed to avoid heavy development of weeds or grasses not desired in the pasture.

(iii.) *Preparatory Treatment.*—The efficiency of sod-seeding will depend upon the preparatory treatment applied. In most cases some reduction of the existing pasture cover is essential to allow correct operation of the sod-seeder and to temporarily check competition so that the new species can establish under favourable conditions.

For example, if white clover is to be sown into paspalum, the operation should be timed for March or early April when paspalum growth is slow. The paspalum would be grazed and mowed low before sod-seeding. Rye-grass should be seeded into an existing white clover pasture during April and it is necessary to sufficiently check the clover so that rapid recovery will not prevent establishment of the rye-grass.

Over-grazing must be avoided as this would cause the pasture to become patchy, and if grazing or mowing will not check the existing pasture enough, then some form of mechanical cultivation must be considered.

A cultivator fitted with narrow tines or a tandem disc harrow will do a good job but care must be taken not to alter soil levels to the extent that irrigation or drainage would be affected adversely.

In vigorous pasture it has been found advantageous after grazing to further check growth by making two or more runs, with the sod-seeder set to deliver a proportionately smaller quantity of seed at each run.

(iv.) *Use of Seeder.* The unit should be carefully pre-set to deliver the correct amount of seed at the right depth. Seeding rates should be higher than normally used when sowing into a fully prepared seedbed, for example, 6 to 10 lb. rye-grass or 2 to 3 lb. of white clover to the acre.

When sowing through plant cover or residue, care must be taken to keep the openers and seed delivery tubes clear.

Fertilizer can be applied at planting time if necessary.

Plate 4

By May 12, 1959, Healthy Rye-Grass Plants were Well Established and the Clover has Fully Recovered.

Plate 5

At July 15, a Heavy Body of Mixed Pasture was available for the Second Grazing; it was first Grazed on June 9.

It is desirable that pasture harrows or upturned spike harrows be used after sod-seeding to cover the seed and to even out the soil surface for future irrigation.

(v.) *Irrigation.*—If suitable rain does not occur, irrigation should be applied either before or after sod-seeding, to ensure germination and early growth.

(vi.) *Treatment after sod-seeding.*—Early grazing management should be planned to foster development of the new pasture. Should the original species tend to suppress the new component, an early mowing may be preferable to grazing.

Top-Sowing also useful

For those who wish to introduce a new species but have neither sod-seeder nor drill, top-sowing may be useful.

The existing pasture is checked by grazing and the seed is broadcast on the surface which has been partially prepared. The area is well-harrowed and then managed similarly to pastures which have been sod-seeded.

Top-sowing can be very successful, but results are achieved more slowly than by positive sod-seeding.

* * *

TIMELY TIP

Order seed and fertilizer for autumn plantings.

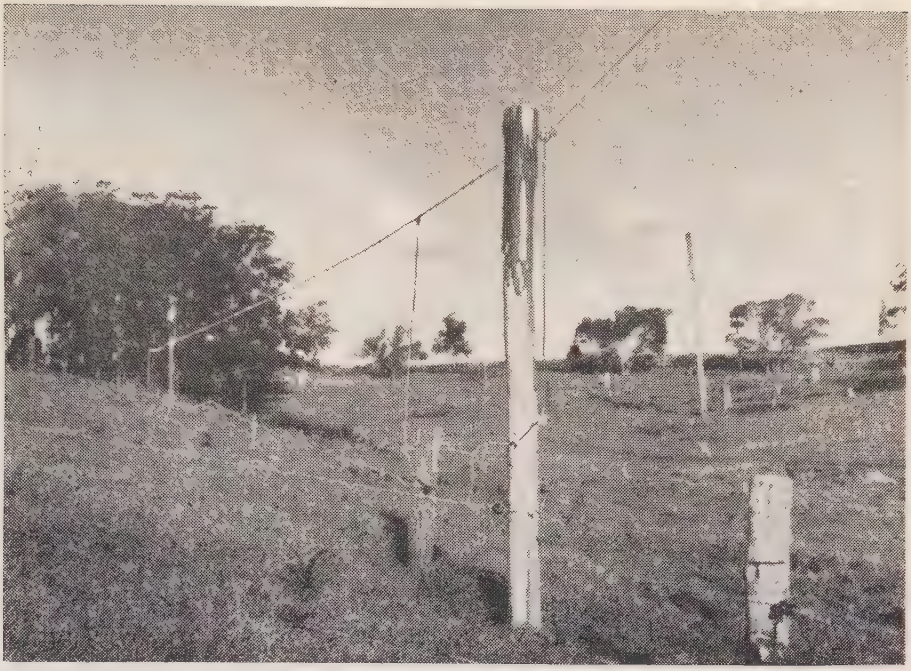

Plate 1

General View of Fencing Showing Overhead Main Wire, Two Gateways and Subdivision Fencing.

A Mains-Operated Electric Fencer

By P. McCALLUM, Senior Dairy Adviser.

Strip grazing of crops and pastures with a battery-operated electric fencer unit is now a fairly common practice on many farms in Queensland. Where electric power is available, a new type of unit, the mains-operated, is gaining in popularity, and present indications are that this unit will be adopted widely.

The mains fencer is an electric fence which draws its initial current from A.C. power supply and is completely safe. This type of mains fencer is widely used in Europe. It eliminates the all-time worry of batteries. The circuit pull is no more than that taken by an electric clock and it is capable of energising many miles of fencing. Mains fencers have also proved valuable for semi-permanent subdivision of farms.

Mr. E. Anderson, Wolvi Road, Gympie, has been able to subdivide an 80-acre paddock into 10 small paddocks at a total cost of £100, using approximately one-and-a-half miles of subdivisional electric fencing of this type. The financial advantage of this form of subdivision has been substantial. A three-wire permanent fence which could cost some £200 a mile, has been replaced by a unit which costs £66 a mile.

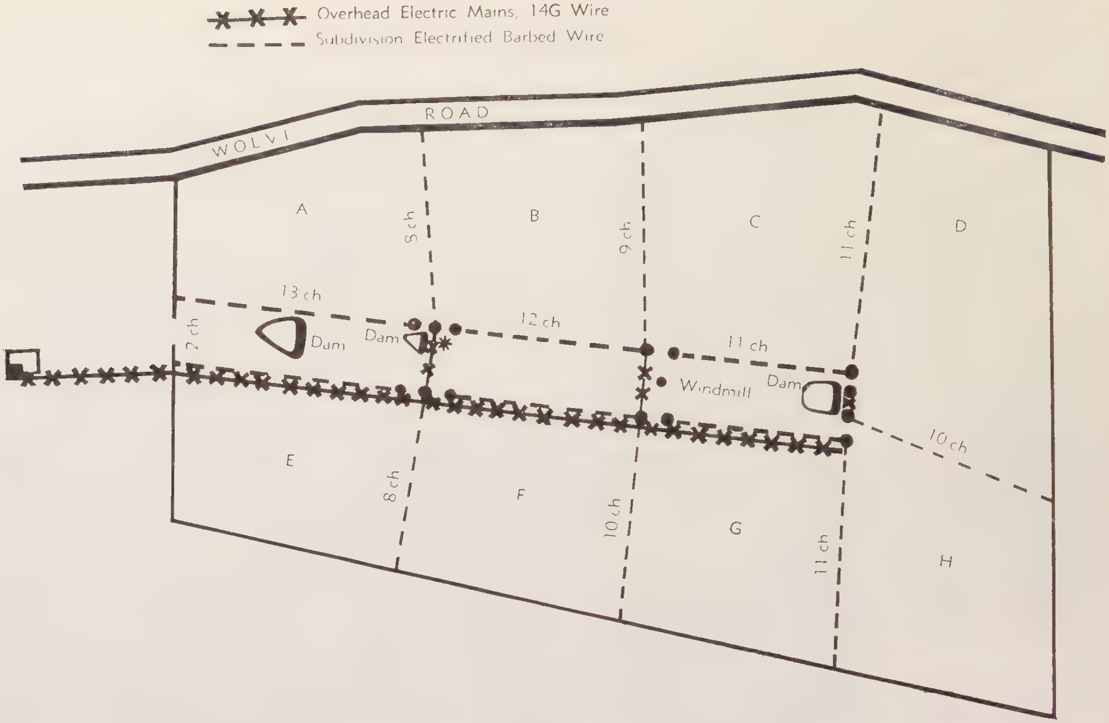

Plate 2

A Plan of Mr. Anderson's Electric Subdivision of his 80 Acre Paddock.

Fence Layout

A plan of Mr. Anderson's electric subdivision of his 80 acre paddock is shown in Plate 2.

The mains fencer is housed in the barn where an electric meter was already installed for other purposes. It is a permanent installation and is sheltered from climatic influences. A permanent lead runs from the "controller" unit in the barn down the centre of the paddock by an overhead 14-gauge wire as far as paddock H. This wire is attached to posts about 9 ft. high by shackle insulators bolted to the posts. This line is continuously energised.

All subdivisional fences are of a single barbed wire mounted on wooden stakes placed approximately half to one chain apart. Barbed wire was used because it was felt that the barbs would carry the electric shock to the animals much better than plain wire. Stock would also respect the barbed wire more than plain.

The wooden stakes are 2 in. by 1 in. timber which was obtained from the local sawmill at no cost as it was considered waste timber. The barbed wire runs at 28 to 30 in. above the ground. It is wired on to button insulators attached to stakes. Heavy reel insulators are used at the strainer posts.

To bring the current from the main line (14 g. wire) to the subdivision fences, lighting arrestor switches are used. Power can thus be "cut-in" or "cut-out" as desired.

The convenient arrangements for gate openings are shown in Plate 3. A rubber hand grip is used on this wire to prevent the operator getting a shock where the power is on.

It is useful to have a mains shock tester available to check any breakdowns in current flow along fences.

Is It Safe?

One of the first questions asked by anyone interested in using a mains operated unit is, "Is it safe?" There is absolutely no possibility of dangerous high voltage current emerging from this

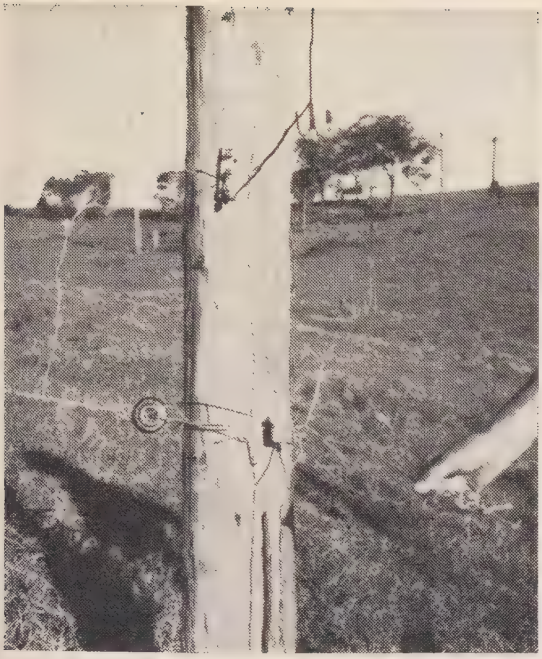

Plate 3

Close-up View Showing Main Wire Leading from Insulator on Pole, through Lightning Arrestor Switch down to Subdivision Barbed Wire, and Gateway.

unit. The mains "controller" unit has been designed to satisfy a very elaborate set of international safety regulations devoted entirely to this subject and covering every aspect of design. Apart from being housed in an insulated box, the whole of the output side is sealed off from the main feed current in such a way that it is impossible for any part of the input circuit to come into contract with the output mechanism of the fencer circuit, whatever conceivable fault conditions may arise. If the condensers or resistances, or indeed any other component part, were to break down, the unit would simply cease to function.

When operating, the electric shock delivered by the unit is very similar to that of the ordinary battery-operated fencer, the number of impulses being 60 a minute.

Other questions which arise concerning the operation of these units and the answers are as follows:

Q. How many miles of wire can be energised by one fencer unit?

A. Between 15 and 25 miles, provided satisfactory insulators are used.

Q. Will more current be used on a longer fence than a shorter one?

A. No. Current consumption is the same regardless of distance.

Q. Is any trouble experienced with cows jumping the fence?

A. No. Cows soon become trained to the electric fence. In this way cattle and horses are taught to respect all wire and thus avoid many accidents.

Costs

The following cost were incurred in the erection of this subdivision

(i.) *Timber.*—The light poles used for the overhead main were cut on the farm. The hardwood stakes were obtained from the local sawmill at no cost.

(ii.) *Materials*—

	£	s.	d.
6 coils of barb wire at £3 5s. a coil	19	10	0
1 mains electric fencer ..	20	11	9
14 g. tie wire	1	18	0
Insulators, lighting arrestor switches, bolts ..	14	11	9
1 mains shock tester ..	2	18	6
(iii.) *Labour.*—The labour involved in cutting and snigging the poles, erecting poles, stakes and wire was 102 man hours—			
102 man hours at 7s. an hour	35	14	0
Installation of fencer (electrician)	4	7	8
Total cost ..	99	11	8

N.B.—The costs for materials used were on the basis of supply to Government Departments.

Advantages of electric fences

What are some of the advantages which have resulted from the subdivision and strip-grazing of paddocks with an electric fencer?

Subdivision.—Subdivision of existing paddocks can be carried out at about one-third of the cost of a three-wire permanent fence. Pasture management can be more effectively controlled and the grazing season extended. Extra or surplus growth can be conserved for use at a later date, or extra stock can be carried to use the extra growth. Where overstocking is not the practice, rotational grazing will not add much to farm income unless either subdivision or pasture management is practised. The level of forage production should be high before subdivision is justified.

Strip-grazing.—Better use is made of the available crops and pasture. Wastage through trampling and dunging is reduced to a minimum. More effective use can be made of animal droppings under intensive grazing conditions. Thus the drain on soil fertility is reduced. The amount of labour required to control stock on the farm is reduced. More milk or butterfat from a given acreage can be obtained. This makes extra land available for other crops. Several authorities claim 20 to 25 per cent. increase in production per acre through strip-grazing.

Mr. Anderson runs an average of 50 cows in his herd and each subdivision is grazed for 2 to 3 days. Water and ample shade are available in the 2 chains wide laneway. Due to the width of the laneway no bogging or cutting up takes place in wet weather.

The fencing project on Mr. Anderson's farm has been established as a demonstration under the Commonwealth Dairy Extension Grant, and is supervised by officers of the Department of Agriculture and Stock.

Another co-operator under the Commonwealth Dairy Extension Grant who has a mains-operated electric fencer is Mr. H. Howard, Maleny. He too is very pleased with its performance and prefers it to other fencer units he has had in the past.

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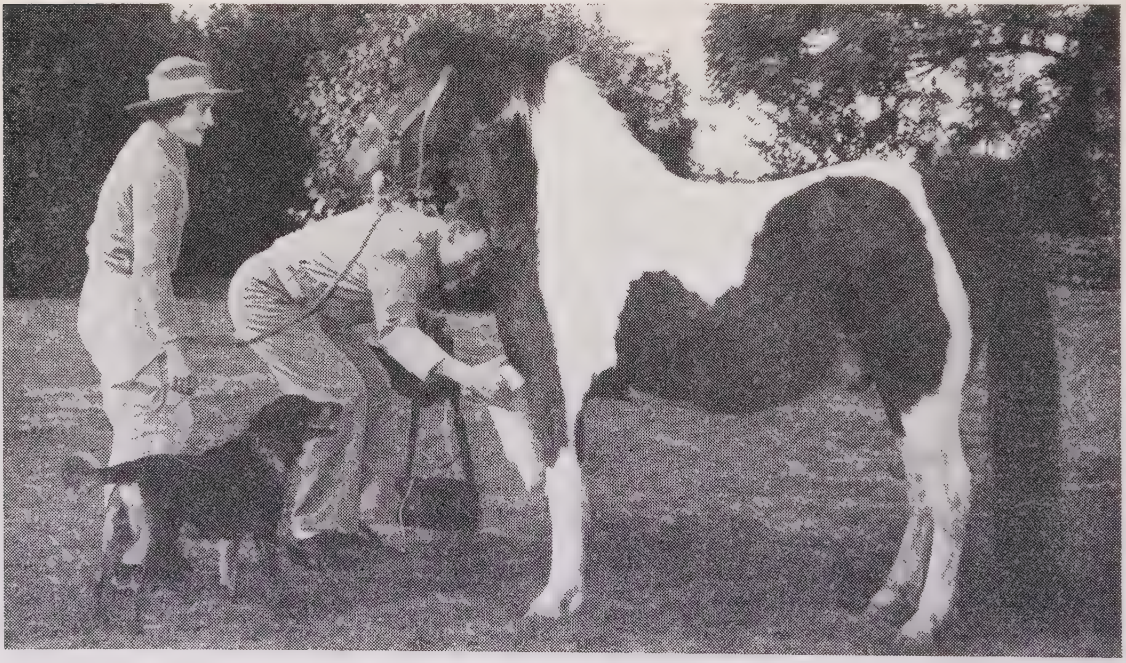

"Courier-Mail" Photographer, Mr. Al Pascoe, Sen., Shakes Hands with Miss Diane King's Pony, "Shandy," on the Lawn at "Kengoon," in the Fassifern Valley. This photograph and those on pages 49 and 65 were taken on the 1960 R.N.A.-Shell Journalists' Tour, which covered many well-known studs and properties in south-eastern parts of Queensland.

Scrub Tick Paralysis

By S. G. KNOTT, Divisional Veterinary Officer.

In this article on the scrub tick and the paralysis it causes in animals, stockowners are advised on prevention and treatment. Those in scrub-tick-infested areas are advised to subject immune animals to light infestations of the tick regularly so as to maintain immunity.

Scrub tick paralysis follows the engorgement of female scrub ticks, *Ixodes holocyclus,* on affected animals. The paralysis moves forward in the body of the victim, often ending in death through respiratory failure.

As few as one or two female ticks are sufficient to cause death, but not every female tick causes paralysis.

The condition most commonly occurs in spring and summer.

Paralysis due to the scrub tick is found along the eastern coastal fringe from far north Queensland to Lakes Entrance in Victoria and parts of Tasmania. In Queensland, it is also found on the Atherton Tableland, Burnett and Brisbane Rivers' watersheds and parts of the eastern Downs.

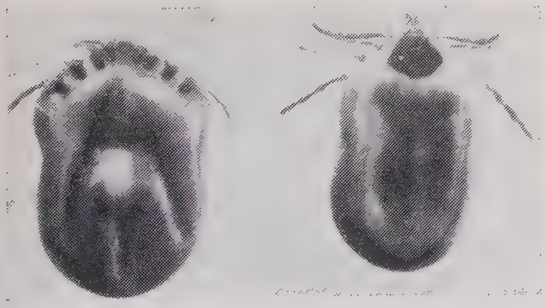

Plate 1

Ventral and Dorsal View of a Semi-Engorged Scrub Tick. Note the scutum or shield from which the long mouth parts project. The legs are long and brown.

Has Many Names

Ixodes holocyclus has many common names, such as scrub tick, paralysis tick, shellback tick, bottle tick and dog tick. Many people often maintain that these are all distinct types of ticks. The reason for this confusion is the relative changes which occur in respect to the scutum (or shield) and the body as the tick engorges.

Early, the female is slaty grey in colour with a light brown scutum, and as engorgement progresses the colour deepens to a grey-green which may show a reddish tinge.

The male is oval and yellowish or yellowish-red in colour. The female scrub tick may be distinguished from the cattle ticks by the following features:—

Characteristic	Scrub Tick Female	Cattle Tick Female
Mouth parts ..	Long and terminal. Palps longer than hypostome	Short
Eyes	Absent	Present
Anal groove ..	Encircles the anus in front and converges behind	Absent
Legs	Long and brown ..	Short and pale

Life Cycle

Ixodes holocyclus is a three host tick. A female takes 6 to 21 days to engorge and then drops off to lay 2,000-3,000 eggs. In warm weather these hatch in 50 to 60 days. After a week, the larvae attach themselves to a suitable host.

The larva feeds for 4 to 6 days and then drops off to moult. This takes 20 to 40 days and the emergent nymphs attach themselves to a suitable host. After 4 to 7 days they engorge and drop off and develop into adults in 3 to 10 weeks. They become active after a week and climb up vegetation to await the approach of a suitable animal.

Bandicoots are the most suitable hosts for the larval and nymphal stages, but they can survive and grow on other animals although the death rate is high.

Adult ticks often wander on the host for 24 hours or more before attachment.

The scrub tick is commonly found on certain native scrub and bush fauna such as bandicoots and possums.

Domestic animals are only accidental hosts.

Dodd proved that *Ixodes holocyclus* was the cause of scrub tick paralysis in dogs.

Most researchers agree that the salivary glands are the source of the neurotoxin or nerve poison. Generally symptoms do not appear until the fourth or fifth day after attachment.

The toxin is transported by the bloodstream to the central nervous system, whereby it has its effects upon the animal.

Little is to be observed on post-mortem.

Symptoms

The symptoms in dogs will be described in detail, and reference will then be made to other animals.

Dogs.—Early signs include a slight inco-ordination of the hindquarters, slight grunting during respirations, lack of appetite, altered voice and some inability to swallow.

The severity of the nervous inco-ordination increases in the hindquarters and ascends to involve the forelimbs.

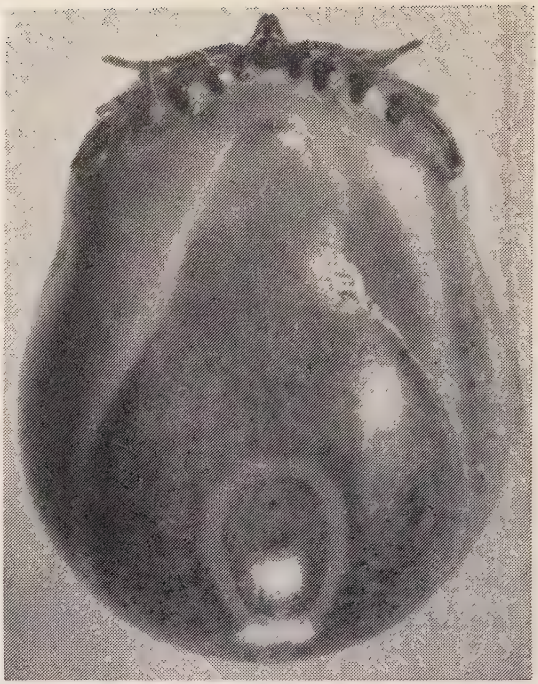

Plate 2

Ventral View of a Fully Engorged Scrub Tick. Note how the anal groove encircles the anus in front and converges behind.

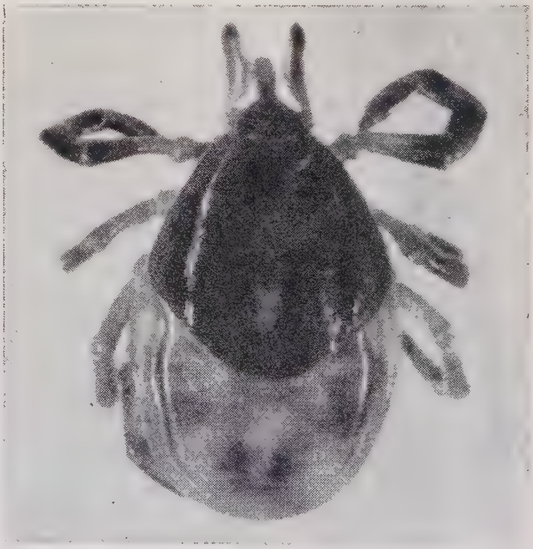

Plate 3

Scrub Tick In The Early Stage of Engorgement. Note the size of the scutum relative to the rest of the body.

Plate 4

Bandicoots are Common Hosts for the Scrub Tick.

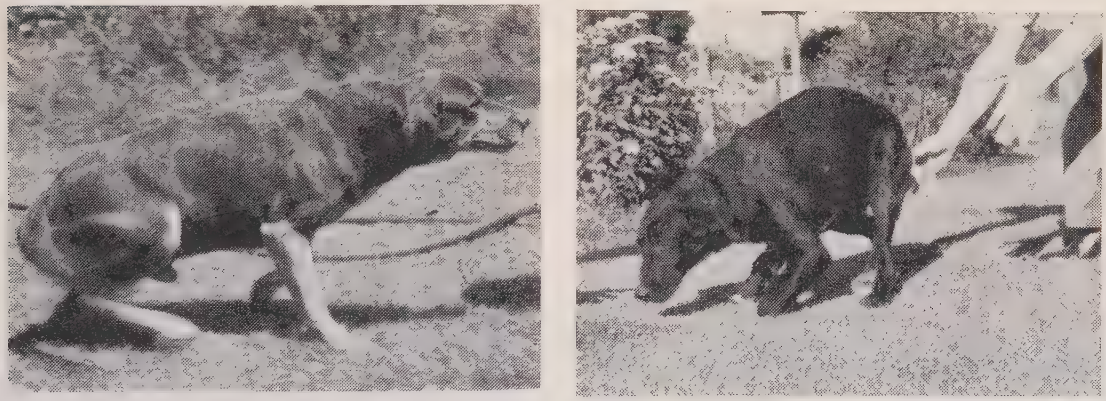

Plate 5

Note the Unsteady Stance in Both Dogs Due to Lack of Control over the Hindquarters

Respiration becomes slow and laboured and vomiting often occurs.

Dogs remain mentally bright and can follow their owner with their eyes and appreciate remarks although unable to respond.

The temperature remains normal or subnormal.

The more rapidly the symptoms develop, the more likely is the case to terminate fatally.

Death is invariably due to respiratory paralysis.

Cats.—A greater percentage of cats survive scrub tick paralysis and they tend to develop a better immunity following recovery. They do not vomit.

Ticks are most commonly found behind the elbows, between the shoulder blades and around the head and neck.

Pigs.—Pigs 10 weeks and under are most susceptible and the condition is ushered in by a wobbly gait.

Cattle.—Calves are occasionally affected but serious losses have occurred in grown cattle.

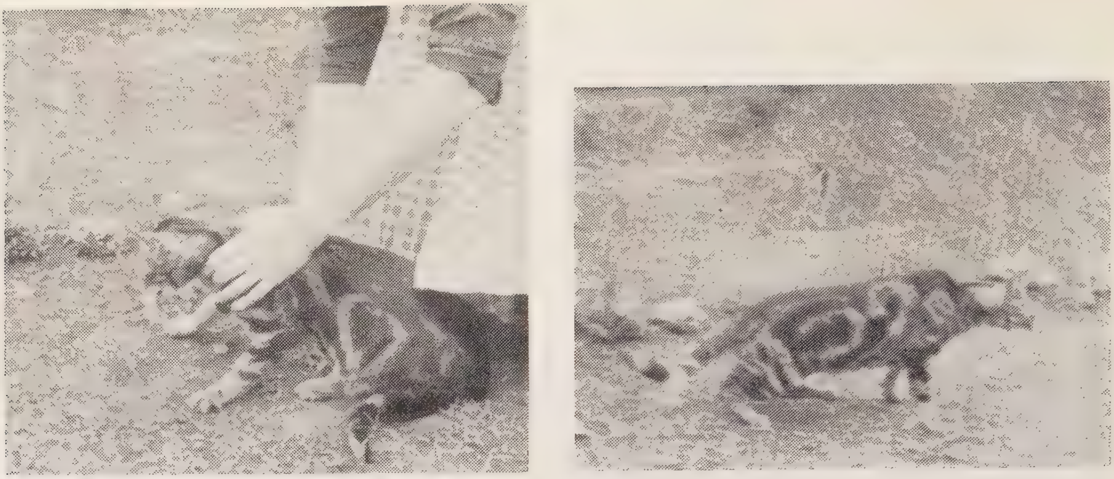

Plate 6

(a) Cat is Unable to Stand Despite Assistance. **(b) Cat Displays Partial Posterior Paralysis.**

Death can intervene quickly or take up to 3 weeks.

Horses.—Foals are very susceptible to scrub tick paralysis. One Atherton Tableland breeder lost 11 out of 13 foals in one season and 7 out of 11 foals another year.

Sheep.—Sheep are very susceptible. The scrub ticks usually attach themselves to the face, especially the lips and eyelids, or under the front and back legs. Keratitis is a common feature of the condition and often precedes the onset of paralysis.

Goats.—Goats may develop posterior paralysis but generally recover. They often develop keratitis and eye discharge in association with the paralysis.

Poultry.—Cases have been recorded in poultry and ducks.

Treatment

Remove the tick immediately, preferably by grasping it with a pair of forceps as close to the skin as possible and giving a sharp tug.

Any mouth-parts left after removing merely act as a foreign body. The important salivary glands always come away with the body.

Some prefer to cut the tick out.

Apply an antiseptic such as iodine to the bite.

Then search for any other ticks.

Plate 7

Baconer Having Difficulty in Regaining its Feet.

The only remedy worthwhile is scrub tick antiserum. The dose is 10 c.c. given by injection, and if the case is not too far advanced the treatment is quite efficient. This preparation is only available from private veterinarians, so contact one as soon as possible.

The serum from dogs with an active immunity often has a curative effect. Some veterinarians have successfully used sera from dogs or dingoes trapped in the scrub and carrying heavy scrub tick burdens.

The patient should be given a soft bed and be made comfortable and kept dry.

With dogs and cats, small light nutritious foods such as egg flip and gravy should be given so as to reduce the likelihood of inducing vomiting. Predigested milk foods are also very good and may be given as an enema.

Foals are best fed by passing a stomach tube.

Prevention

Dogs.—Preventive measures hinge around two factors.

(*a*) The ticks are usually attached, although unobserved, for at least 4 to 5 days before the development of symptoms.

(*b*) Tickicides such as BHC and DDT at the correct strength will kill any attached ticks and protect against attachment for a number of days.

Plate 8

Calf Struggling to Rise.

Therefore, daily inspections made by feeling with the fingertips and paying particular attention to inside the ears, lip, nostrils and eyes, associated with weekly tickicide treatments, give the best possible protection available.

Weekend baths can be alternated with midweek dustings with the following preparations:—

Preparation	Wash Containing	Dusting Powder Containing
BHC	0·1% gamma isomer BHC	0·2–0·5% gamma isomer BHC
DDT	1–2% DDT ..	10% DDT
Malathion ..	..	1% Malathion
Derris	2 oz. per gallon soapy water	Derris Dust containing 5% rotenone

Cats.—Gammexane and DDT are very toxic to cats, and the insecticide of choice for cats is Malathion. Derris can be used as an alternative.

Farm Animals.—Clear the paddock of scrub, shrubs, undergrowth and long grass, as this will discourage bandicoots. This is particularly important in pig pens. It may be necessary to house suckers at certain times of the year until this is done.

Weekly sprayings with 0·1 per cent. gamma isomer BHC or 1 per cent. DDT give good protection. Therefore, clear undergrowth and spray weekly when conditions are suitable for ticks.

One sheep farmer reports excellent control by dipping lambs with toxaphene or dieldrin every 10 to 14 days when scrub ticks become prevalent.

Immunity

Dogs which survive attacks do develop an active immunity. Many dogs on heavily infested areas such as the scrub land farms of North Queensland can carry a burden of scrub ticks with impunity. However, the immunity is not a permanent one and if such dogs are kept free of scrub ticks, then their immunity declines rapidly and may be lost after 6 months.

Immunity is acquired and not inherited.

Some breeds of dogs such as beagles, foxhounds, retrievers, pointers and setters possibly have a greater natural resistance than others.

Puppies whelped in a scrub tick area are easier to rear than introduced ones and this is doubtless due to immune bodies received from the bitch when suckling, providing she has active immunity herself.

Plate 9

Foal Unable to Stand Despite Assistance.

There is no injection which provides an active lasting immunity against scrub ticks.

It is an interesting fact that while wild indigenous fauna have a high natural resistance, it is only as the result of infestation that it becomes complete.

Bandicoots trapped in scrub-tick-free areas will develop scrub tick paralysis and occasionally die when heavily infested. The partial natural immunity must be reinforced by active infestation.

In Brief

1. *Ixodes holocyclus* is the only species of tick capable of causing scrub tick paralysis.

2. A neurotoxin secreted by the tick's salivary glands affects the central nervous system.

3. Early symptoms include slight posterior inco-ordination and grunting respirations.

4. Remove the tick and seek veterinary advice regarding treatment and the availability of antiserum.

5. Search small animals daily for ticks and apply regular weekly treatments with suitable tickicides.

6. Clear paddocks, runs and pens of unnecessary weeds, long grass, and shrubs.

7. Allow immune animals to obtain light infestations regularly to maintain immunity.

Protein Production and Grass Use

The key emphases in lifting output from Queensland pastures were greater protein production and more efficient grass use. This was stated by Mr. L. R. Humphreys, Chief Agrostologist, after his return from a 5 months' overseas tour. Mr. Humphreys attended the 8th International Grassland Congress at Reading, and after visiting research institutes in the U.K. and Holland, returned home via Kenya, Southern Rhodesia and South Africa.

Pastoral problems in many parts of Africa were very similar to those in Queensland, he said. The biggest single difficulty was the almost universal protein shortage, which operated for a large part of the year and limited the proportion of the abundant grass an animal could eat. This protein shortage was being attacked vigorously by the development of legume-grass pastures, by a more intensive use of nitrogen fertilizer, by the use of annual legume forage crops such as jack bean or velvet beans, or by the feeding of urea and molasses.

Mr. Humphreys was unimpressed by differences in animal productivity between different improved grasses, either in the U.K. or South Africa. Obviously some grasses were better suited to particular regions or soils, or particular farming jobs, but differences in productivity were small compared with the benefits that could be gained from legume development, proper fertilizing, and pasture management. In Southern Rhodesia green panic and Katambora Rhodes grass were superior to Australia commercial Rhodes in suppressing nematodes in tobacco rotations. Sorghum almum in South Africa was regarded as a useful plant on heavy soils, but it rarely persisted more than 3 years. South Africa had less Johnson grass than Queensland, he added.

Ley farming was an important research emphasis in the three territories visited. A proper balance of crops and pasture alleviated seasonal food shortages. Roughly speaking, the degree of success in maintaining maize yields in a pasture rotation depended on how much nitrogen had been added to the pasture, either by legumes or by nitrogenous fertilizer.

Be sure to jet to the skin

By R. B. YOUNG,

Senior Adviser in Sheep and Wool.

Plate 1

Jetting Rams on a Western Queensland Sheep Station.

Jetting is a well-established method of applying insecticides to sheep's wool to prevent or control blowfly strike.

It is useful as preventive action when fly waves appear imminent, and is the main method for emergency action when rapid increases in fly populations cause widespread strike. It is very useful for the treatment of weaners to tide them over the period when they are highly susceptible to fly but too young to Mules because their wrinkle development is still in progress.

The general technique of jetting is to use pressure to force fluid impregnated with insecticide through the wool so that the sheep is saturated to the skin. It is necessary to treat the whole of usually susceptible areas and the surrounding wool.

Where to Jet:

Rams—Around horns, well down between horn and head (taking care not to squirt into ear), poll, top of head, and back to top of neck. A body strip, crutch jet, and "pizzle" jet is also advisable.

Wethers—Completely ring the wool around the "pizzle" with insecticide, as well as giving the normal jetting.

Body—Top of head, top of neck, withers, and 6 in. side-strip along the back to the tail, going on to a full crutch jet.

Crutch—Above and around tail, cover rump in such an area as is usually involved in a full crutching, apply between legs to udder, lift the tail to get good coverage around vulva, go down legs to below hocks, in fact as far as there is wool, since dung and urine often splash the lower legs and form site for re-strike.

Slap-dash Methods

This article is written mainly to stress for sheep-owners the need to jet thoroughly.

Why is more care needed in jetting than is frequently practised? Looking back through the history of jetting practices, it is easy to recall how the advent of more efficient modern insecticides gave to sheepmen a feeling of great confidence, almost to the extent that a state of complacency arose. This over-confidence led in some instances to less thorough jetting techniques.

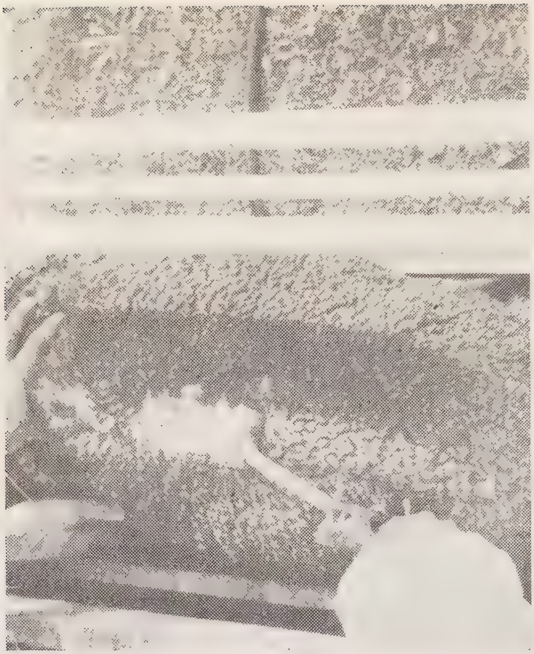

Plate 2
Comb the Wool While Jetting.

Even in the days when arsenic was the only available insecticide, some jetted efficiently and the results were favourable; others were less conscientious and the results were not so good.

Research to find better insecticides brought to light more effective maggot killers, with the added advantage many possessed of much reduced risk of poisoning for both sheepman and sheep. Even in those cases where less efficient techniques were used with insecticides such as aldrin and dieldrin, results were frequently very favourable.

This was largely due to the property possessed by some of the insecticides, such as BHC, aldrin and dieldrin, to "diffuse" and penetrate into portions of the fleece that had not received actual application of the insecticide. This "diffusion" property enabled the toxic material to move down untreated portions of the wool, or to invade new wool that grew following jetting. Such insecticides as aldrin and dieldrin protected areas some distance from treated wool.

Diffusion

In 1953, South African workers published a paper describing how some insecticides appeared to move down the wool fibre towards the skin of the sheep, and to continue to do this as new wool grew. This was the characteristic termed "diffusion." An obvious advantage of this property is that when new wool grows following jetting, showering, or plunge dipping, in an insecticide with high diffusion behaviours the new wool will become impregnated with toxic material and have the power of remaining toxic near skin level. **The concentration will not be as high as in those parts of the wool where the insecticide was first applied, but will remain for some time, with diminishing value.**

Results from the South African trials indicated that some time after jetting to the skin with 0·5 per cent. aldrin, the concentration on the wool actually treated was 1,000 parts per million, whereas the concentration in the wool grown subsequent to jetting was 64 p.p.m. in the wool grown **immediately** after jetting, and 16 p.p.m. in the **most recently** grown wool.

In South African trials, DDT was found to have a low diffusion value, whereas other insecticides, notably aldrin, dieldrin and diazinon, had high diffusion value. The diffusion value did not alone determine the residual efficiency; the toxicity of the particular insecticide was also important.

Dieldrin, for example, has not such a rapid diffusion rate as BHC, but because of its relatively greater toxicity to blowfly larvae, it affords a longer protection against strikes.

Some insecticides move along the wool fibres; some don't. Some have greater toxicity than others, but less movement after being applied. Some are relatively more toxic than others for the initial period following jetting, although their concentration in old and new grown parts of the wool may decline more rapidly.

Some vaporise more rapidly than others. Diazinon has the chemical reputation of being somewhat volatile. Trials have suggested that winter jetting with diazinon gives longer protection than summer jetting, when the heat conditions are more conducive to rapid evaporation.

Aldrin and dieldrin have frequently shown that in some manner they can move to areas of the fleece lateral to the area treated. With diazinon this ability to move laterally is very limited.

The reason for this variation in behaviour between hydrocarbon insecticides such as aldrin and dieldrin, and organic phosphates, such as diazinon, is not fully clear.

Diazinon is a highly effective insecticide, although varying in some points of behaviour from dieldrin and aldrin. Its general usefulness is at present very important, because to date there are no indications in blowfly control work that strains of blowfly that have shown resistance to aldrin and dieldrin have been other than fully susceptible to diazinon where application has been efficient.

Recommendations

In sheep areas where aldrin and dieldrin are used, there is still a good case for jetting to the skin, for no matter how superior or inferior the diffusion power of an insecticide, it is most important that the concentration to destroy the maggots is high for as long as possible at skin level.

With diazinon, with which both research trials and field use have appeared to establish a lesser ability to move out and about in the wool, the implication is obvious; that it is necessary to jet to the skin and over the whole area to be protected.

Recommendations for the use of diazinon are that for body strike prevention it should be jetted to skin level at a concentration of 0·02 per cent., and for crutch strike control, when some of the flock are already struck, at a concentration of 0·04 per cent.

Quicker and more thorough jetting is possible with a 3-nozzle type of spray than a single jet. Types of 3-nozzle sprays in general use have apertures around 1/16 in. to each jet.

The wool should be combed until fluid is seen to be flooding the skin.

Pressures up to 75 lb. p.s.i. are suitable. If pressures are too high, with the wool combing type of jetting, some damage could be done to sheep with strike wounds. Jetting pressures for tender-skinned lambs and weaners, particularly when they are slack open wool types, or already fly-struck, need to be reduced from 75 p.s.i. to about half that figure. It is likely that at least ½ gal. of fluid per sheep will be used, particularly where a body strip down the back is jetted as well as the breech.

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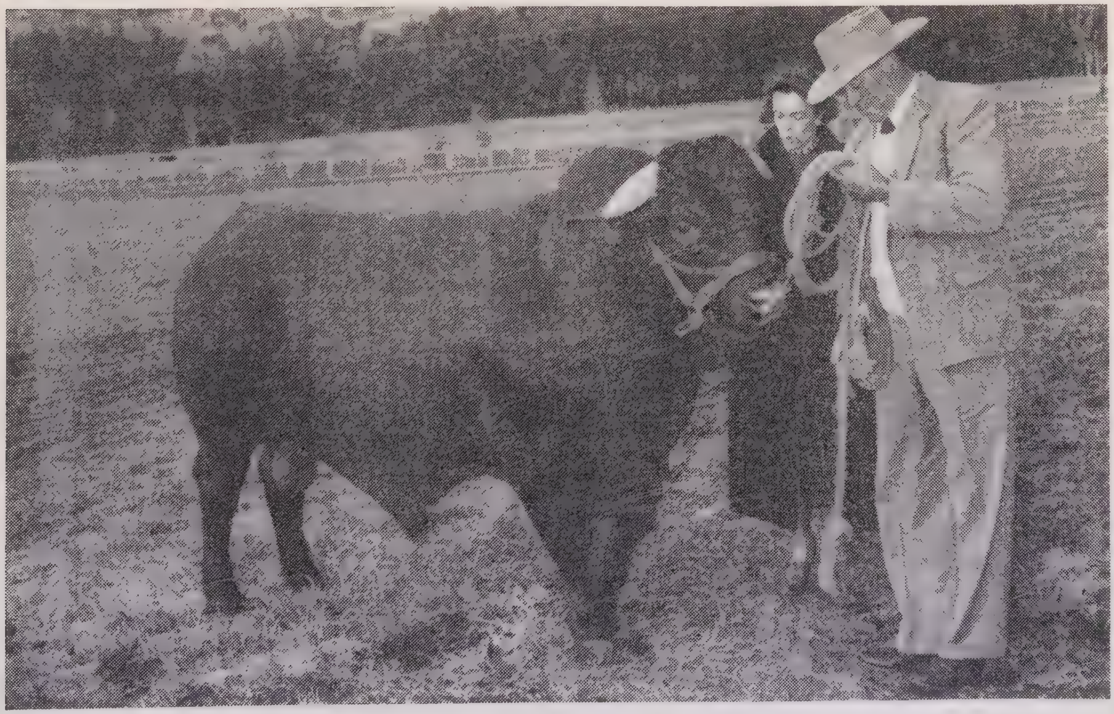

Mr. and Mrs. Howard Douglas with "Risdon Emperor," Australian Bred Santa Gertrudis which Gained Championships at Sydney and Brisbane. After the photograph was taken this bull was weighed at 2,154 lb.

Three-Way Benefit From Green Lot Feeding

By I. H. RAYNER and F. PURSER, Cattle Husbandry Branch.

- *Carrying capacity doubled.*
- *Freedom from bloat, which was previously a constant problem.*
- *A great saving in time formerly spent taking cows to and from feed and moving the electric fence.*

These are the main benefits which Mr. Pat. Evans, of Warwick, attributes to green lot feeding.

Green lot, or soilage, feeding means cutting the feed and taking it out to the stock rather than allowing them to graze. With a forage harvester, and an ingenious home-made trailer, Mr. Evans uses this method to feed his dairy herd on lucerne.

Before he purchased his forage harvester, Mr. Evans fed a herd of 26 cows on 25 acres of irrigated lucerne, together with small areas of crop and grassland. Although he managed to make some hay, most of the lucerne was usually needed for grazing. This year he fed 39 head on only 13 acres of lucerne, leaving a surplus of 12 acres for hay. As it was a good season, 6 acres would probably have been cut for hay if the lucerne had been strip grazed, so the actual saving was 6 acres of lucerne. Other feeding was not changed except that 14 acres of sudan grass, which was used each year in the past, was not needed this year. In all, Mr. Evans estimates that he can now adequately feed more than twice as many cows on the same area.

In the past an average of 2½ hours daily was spent in shifting the electric fence and travelling the cows between the milking shed and lucerne paddock twice daily. The herd can now be kept continuously in a small paddock adjacent to the bails. At a generous estimate, 1 hour daily is spent cutting and carting feed. This includes time to hitch up the forage harvester on occasions when the tractor has been used for other work.

Having cut a load of green feed, the trailer is taken to a point handy to the milking shed, the sides opened down, and the herd allowed to help themselves. This method has several advantages: Troughs or racks are not needed. The time necessary to fill troughs, or alternatively, the cost of equipment to do this mechanically, is saved.

The trailer may be parked at different points in order to distribute droppings and avoid bogging.

Total cost of the trailer was £60. This included £10 for the old truck chassis and wheels on which it was built.

The trailer body has a frame of 1¼ in. angle iron. Upper sections of the sides and the ends are sheeted with flat galvanised iron. Wooden doors—which run the full length of both sides, three on each side—open down as indicated in Plate 6. The wooden floor of the trailer, and the doors when open, are supported by 6 ft. 3 in. lengths of 3 in. by 1½ in. hardwood fixed across the chassis (marked A in the diagrams).

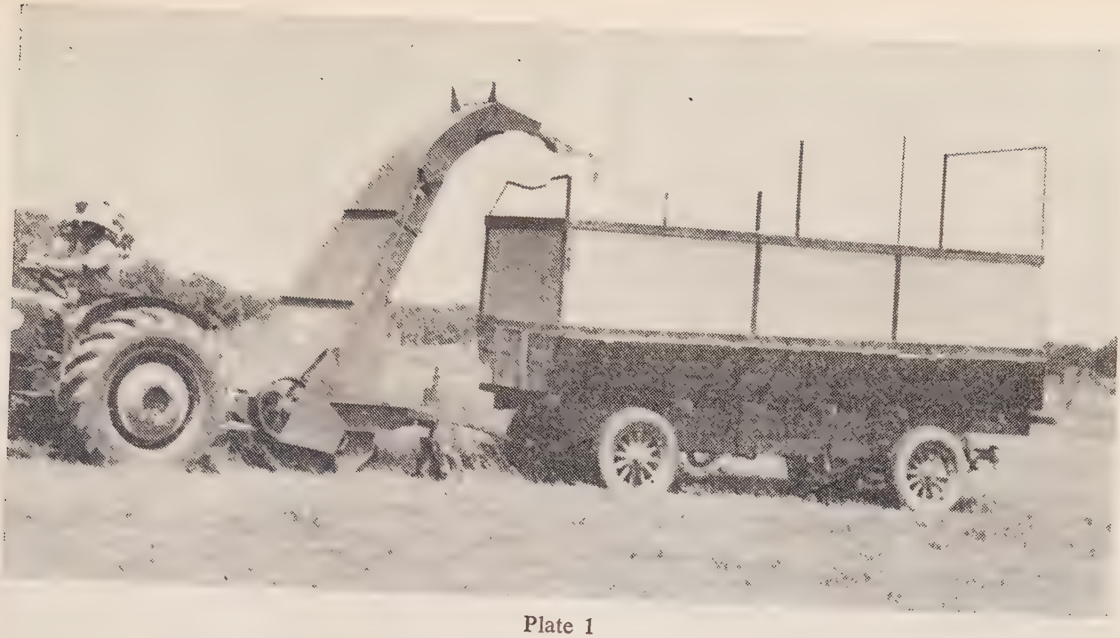

Plate 1

Harvesting Green Lucerne at Warwick.

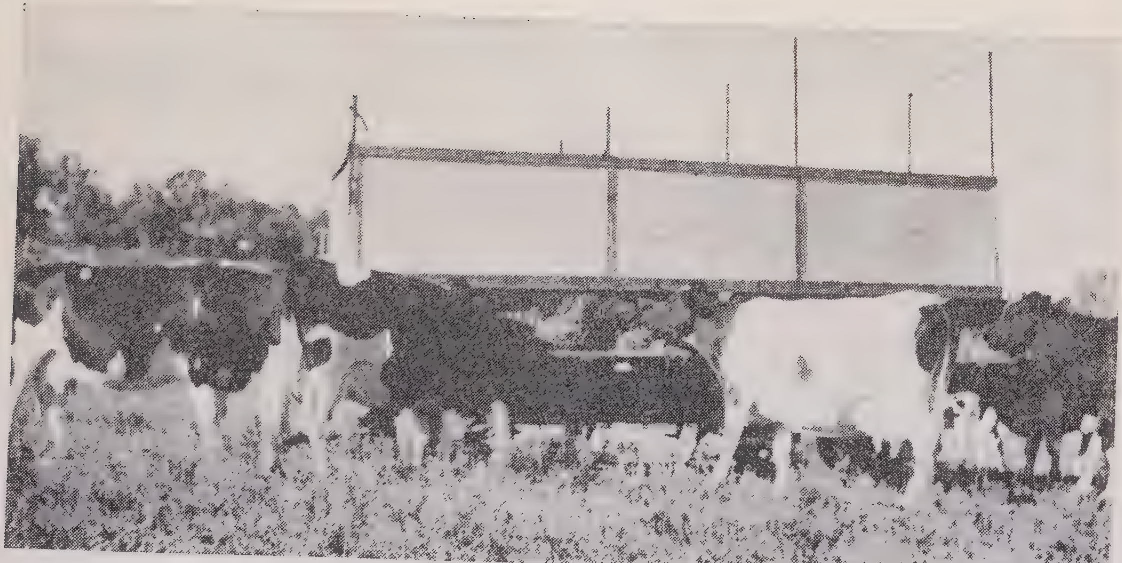

Plate 2

Side View of the Trailer in Feeding Out Position.

Plate 3

End View of Trailer in Feeding Out Position.

Thirty-two cows and 7 heifers are being fed from this trailer with one load daily. They are not all allowed access at once. When the cows are receiving most of their feed from the trailer Mr. Evans considers that more feeding space than this would be desirable.

Mr. Evans intends to use green lot feeding continuously. His trailer has therefore been built solely for this purpose. However, the design could be easily modified to allow side or rear unloading for silage making.

Such a dual purpose trailer has been built by another Downs dairyman, Mr. Jim Ahern, of Southbrook, for less than £45. Although he purchased a forage harvester mainly for silage making, Mr. Ahern realized that green lot feeding would pay dividends on his farm during some periods.

The body of Mr. Ahern's trailer is built on a welded 1 in. pipe frame. It can be easily removed, enabling the trailer to be used for other cartage. The ends are sheeted with 16 gauge steel, providing a smooth surface so that chopped fodder can be easily unloaded in silage making. The side doors are of wire netting on pipe frames. One side (as illustrated in Plate 5) has two doors, while the other has only one, the bottom section being fixed.

This trailer has proved quite satisfactory for both silage making and feeding. For feeding, the top doors on both sides are opened as shown in Plate 8. The method of unloading is illustrated in Plate 7. Both doors are opened and the load pulled off using a wire netting "mat". The netting, placed in the trailer before it is filled, is attached to the bottom pipe along one side. The other end oof the netting is attached to a movable bar (marked B in Plate 7) which is hooked to the top pipe on the other side while the trailer is filled.

One improvement is suggested by Mr. Ahern. He thinks that the top door on the unloading side should be 6 in. higher, that is hinged 5 ft. from the trailer floor. This would make it easier to remove big loads.

Although green lot feeding allows the maximum utilisation of fodder crops it cannot be profitably employed on all farms. It will pay dividends when the value of the extra production obtained is greater than the cost involved, which is at the same time less than the costs of other methods which would give a similar increase in production. Some of the factors which must be considered by anybody interested in green lot feeding are:—

The quality and quantity of feed available.

Amount of extra equipment needed—generally it will be possible to use some machinery which is already on the farm.

The farm layout, with particular regard to the need for convenient, all-weather access from the crop paddock to the feeding area.

For those who have a limited area of feed available for most of the year, expenditure on special equipment for green lot feeding will often be worthwhile. Under these circumstances carrying capacity can undoubtedly be increased by this method. Others could obtain similar benefits when, as often happens, a limited quantity of green feed is available during a dry spell. By cutting and feeding out, its usefulness can be greatly extended. The purchase of equipment for this purpose alone may not be warranted. However, when the expenditure is justified for silage making, green lot feeding allows a profitable additional use.

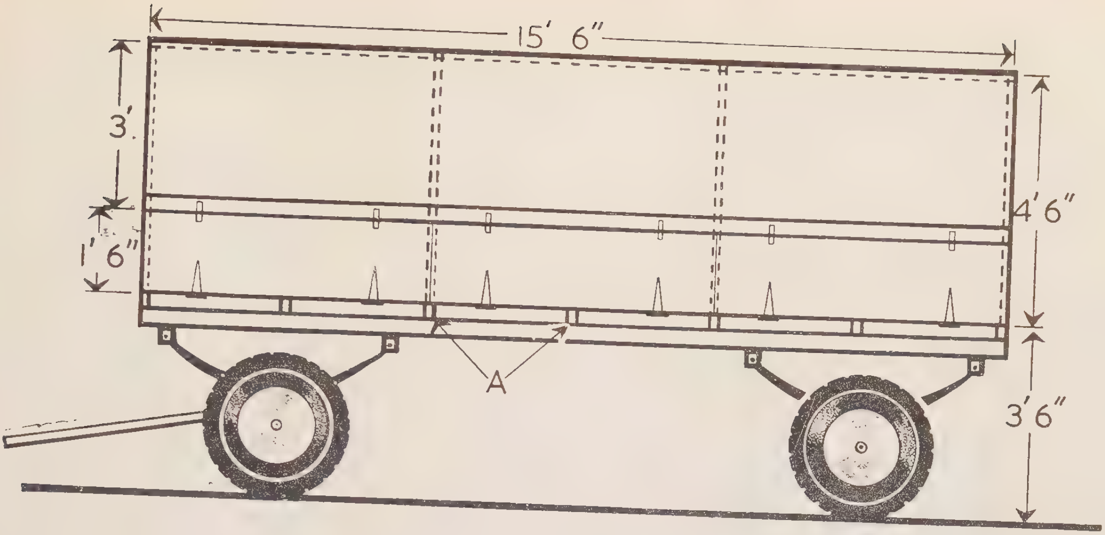
15′ 6″
3′
1′ 6″
4′ 6″
A
3′ 6″

Plate 4

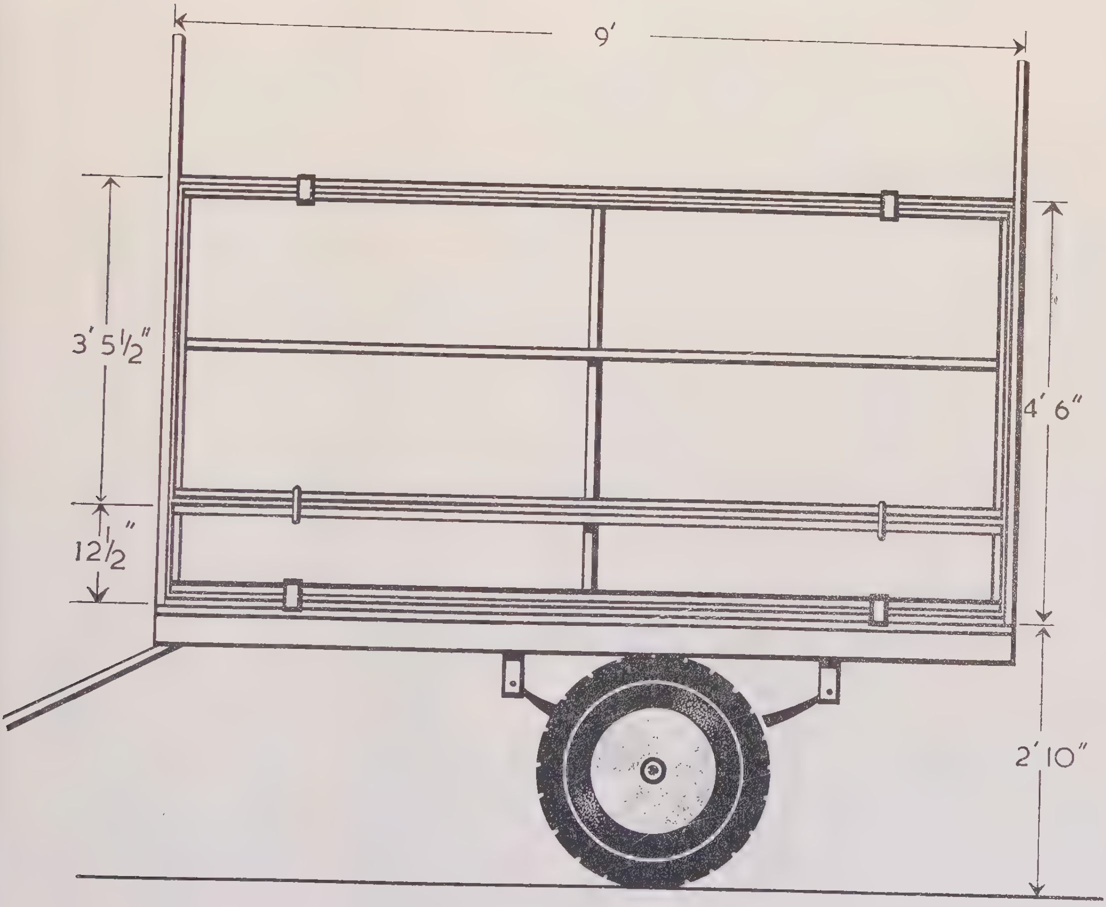
9′
3′ 5½″
12½″
4′ 6″
2′ 10″

Plate 5

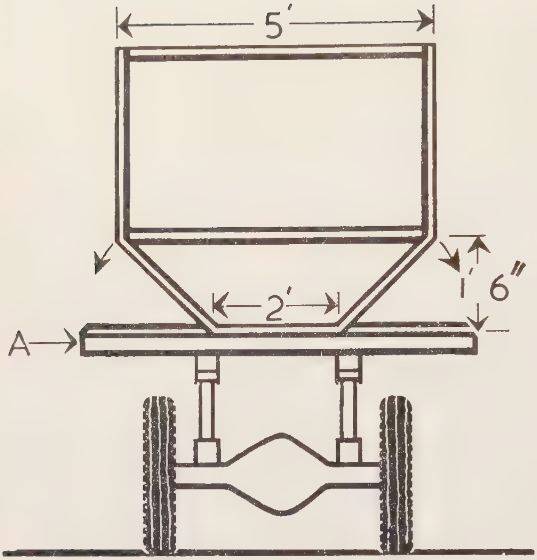

Plate 6

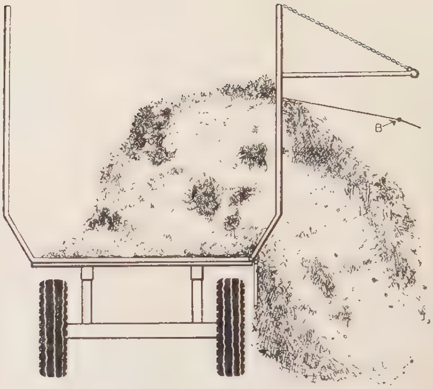

Plate 7

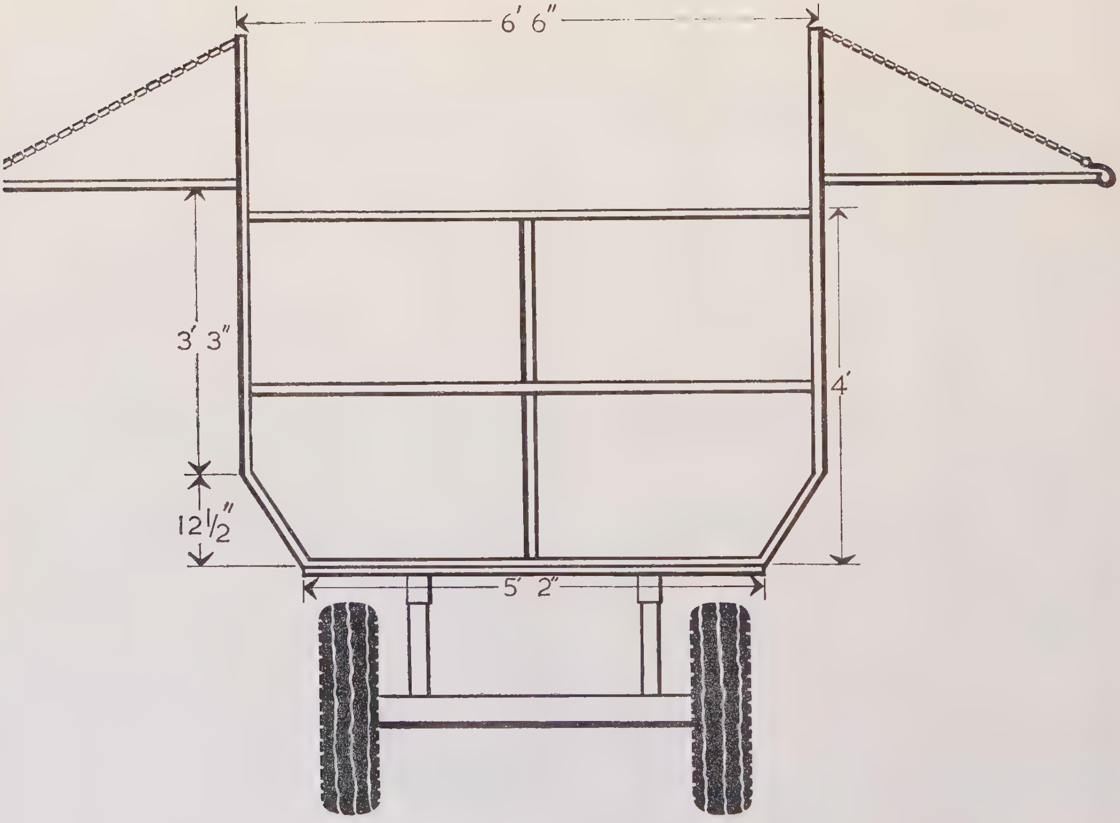
6′ 6″
3′ 3″
4′
12½″
5′ 2″

Plate 8

Brucellosis-Tested Swine Herds (As at 1st January, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., Ascot, via Greenmount
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Barron Bros., "Chiltern Hill", Cooyar
Bell & Son, E. J., "Dorne", Chinchilla
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Clark, L. D., Greens Creek, Gympie
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton" Stud, Maleny
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warra", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Mannuem Brae" Stud, Mannuem, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yaralla" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Skyring, G. I., "Bellwood" Stud, via Goomeri
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Wieland, L. C. & E., Lower Cressbrook, Toogoolawah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Campbell, P. V., "Lawnhill" Stud, Lamington
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Helidon
Wieland, L. C. & E., Lower Cressbrook, Toogoolawah

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kunawyn", Acacia Rd., Kuraby
Kingsford, D., "San Antone", Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Nara

Landrace

shwell, J., "Greenhill", Felton South
Behm, A. M., "Aleun", Wondai
Crawford, G. L., "Glenvillan", Manneum
Brothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., Killarney
zstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
ensen, A. P., & Grace, V. S., Theodore
ones, K. B., "Cefn", Clifton
ajewski, W. & Son, "Glenroy", Glencoe
ath, E. E., "Topcamp", via Toowoomba
Kingsford, D., "San Antone", Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Pointon, E., Goomburra, M.S. 869, Allora
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Tuberculosis-Free Cattle Herds

(As at 1st January, 1961)

Aberdeen Angus

Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgo
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boona

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
Harley, G., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu
Wilson & McDouall, Calliope Station, Calliope

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

pasture and crop

Ronpha Grass.—Production of viable seed of Ronpha grass is rapidly approaching a successful conclusion in the work being carried out by Mr. B. Grof, at the Regional Experiment Station, Biloela.

This grass is the result of a natural inter-specific cross between Toowoomba canary grass (*Phalaris tuberosa L.*) and reed canary grass (*Phalaris arundinacea L.*) which occurred in Transvaal, South Africa.

The hybrid combines several good features of the two parent species and provides a very acceptable grass for irrigated pastures for dairying and for cattle fattening on the alluvial soils of central Queensland. Previously, it has been propagated only vegetatively.

Some viable seed of this hybrid was obtained by the use of colchicine, a drug which diffuses into plant cells causing "doubling" of the chromosomes. The particular phenomenon recorded following treatment of Ronpha grass is called decaploidy and the plants with 70 somatic chromosomes instead of the 35 as in the original hybrid, contain the highest number yet produced in this genus.

Propagation of desirable plants is in progress and appropriate breeding methods will be applied in order to obtain constant types, having normal seed-set and a high resemblance to the parental hybrid as regards forage characters, winter vigour and persistence in a clover sward under irrigation.

—W. A. R. COWDRY, Senior Experimentalist.

Maize At Atherton.—Maize experimental work at the Regional Experiment Station, Kairi, has for its objective the improvement of yields by:

(*a*) The use of pastures to improve soil fertility;

(*b*) The use of suitable hybrid strains;

(*c*) Development of better farm methods and farm machinery; and

(*d*) The use of fertilizers.

Yield data from experiments just completed have shown that on soil which is under a pasture-crop rotational system, yields varied between 92 and 103 bus. to the acre, and there were no significant yield increases resulting from the application of fertilizers.

On soil continuously cropped for 30 to 40 years, however, the average yield where no fertilizer was applied was 50 bus. to the acre and where 4 cwt. of sulphate of ammonia had been applied it was 90 bus. to the acre. There was no significant increase in yield following the addition of superphosphate, although this did cause greater vegetative growth and earlier maturity. Potash seemed to have no effect whatever.

In both experiments the variety used was GH128 (a hybrid) and it was planted in rows 3 ft. 8 in. apart with 12 in. between the plants.

The results indicate that old maize soils on the Atherton Tableland can be made quite productive by the use of a suitable hybrid strain, by close spacing and the application of nitrogen.

It is better, of course, to have the nitrogen in the soil in the form of humus. This can be done by putting the land under a leguminous pasture for a few years.

Investigations aimed at finding the best type of pasture and the period needed to rebuild lost humus are a most important phase of work at this Kairi Station.

—G. W. KYNEUR, Officer-in-Charge,
Kairi Regional Experiment Station.

Soil Reaction and Lime Requirements.—Most soils require lime at some time if they are used for cultivation, particularly if small crops are being grown, and large quantities of fertilizer have been applied.

Lime is added to the soil for three reasons:

1. To increase the amount of calcium in the soil.
2. To improve the structure of the soil.
3. To raise the soil reaction or pH of the soil, that is, to make it less acid.

Some plants grow best in a strongly acid soil, others grow only in an alkaline soil, but the majority of plants require a soil that is slightly acid in reaction.

Acid soils are favoured by such plants as parsley, potato, strawberry, maize, oats, peanuts, azalea, iris, rhododendron and ranunculi. Those plants that grow best in alkaline soils are beet, lettuce, lucerne, carnation, chrysanthemum, dahlia, sweetpea and stock.

—P. HASSLER, Senior Soils Technologist.

Show Beef Gained 1.3 lb. A Day

A pen of three animals in the Department's beef carcass competition at the 1960 Royal National Show made an average lifetime liveweight gain of 1·3 lb. a day.

For the past two years, the Department has sponsored a class in the carcass section of the Royal National Show. The class is for a pen of three steers or heifers, pasture and/or crop fed, judged to be the most suited to the requirements of the local trade. Animals are to have no more than four permanent incisor teeth erupted and the desired weight range is from 400 to 600 lb. hot dressed weight.

The judge on both occasions was Mr. L. Jones, a Brisbane butcher and meat-buyer.

Entries in 1960 reached a high standard and pleased the judge. He stated that all the entries were well suited to the present-day requirements of the local trade. Most of the entries comprised very young animals; in fact, five entries consisted of animals showing no permanent incisor teeth. None of the prize-winning pens contained animals with permanent teeth. The prize-winners were: 1st, Harpham and Harpham, "Yandarlo," Miles; 2nd, C. E. Seiler, "Maybe," Wandoan; 3rd, J. D. Land, Yuleba.

As a matter of interest, the pens were placed in order of merit on the hoof but this was not considered in the carcass judging. Prizes were allotted on the basis of the carcass judging only. The judging system provided for a separate score for each carcass.

Mr. Harpham's first prize pen were born in December, 1958, and January, 1959. They were weaned in July, 1959, and grazed on sorghum stubble until September. Sorghum and urochloa grazing were available from November until March, 1960. Another break without crop occurred then, but during the last week in May the steers were grazed on oats which lasted until Show time.

This pen had an average hot dressed weight of 488 lb. and an average liveweight of 837 lb. at the Show. The average lifetime liveweight gain was 1·3 lb. a day.

Plate 1

The Judge, Mr. L. Jones (right) Points Out the Outstanding Features of the Highest-Scoring Carcass to the Minister for Agriculture and Forestry, Hon. O. O. Madsen, M.L.A.

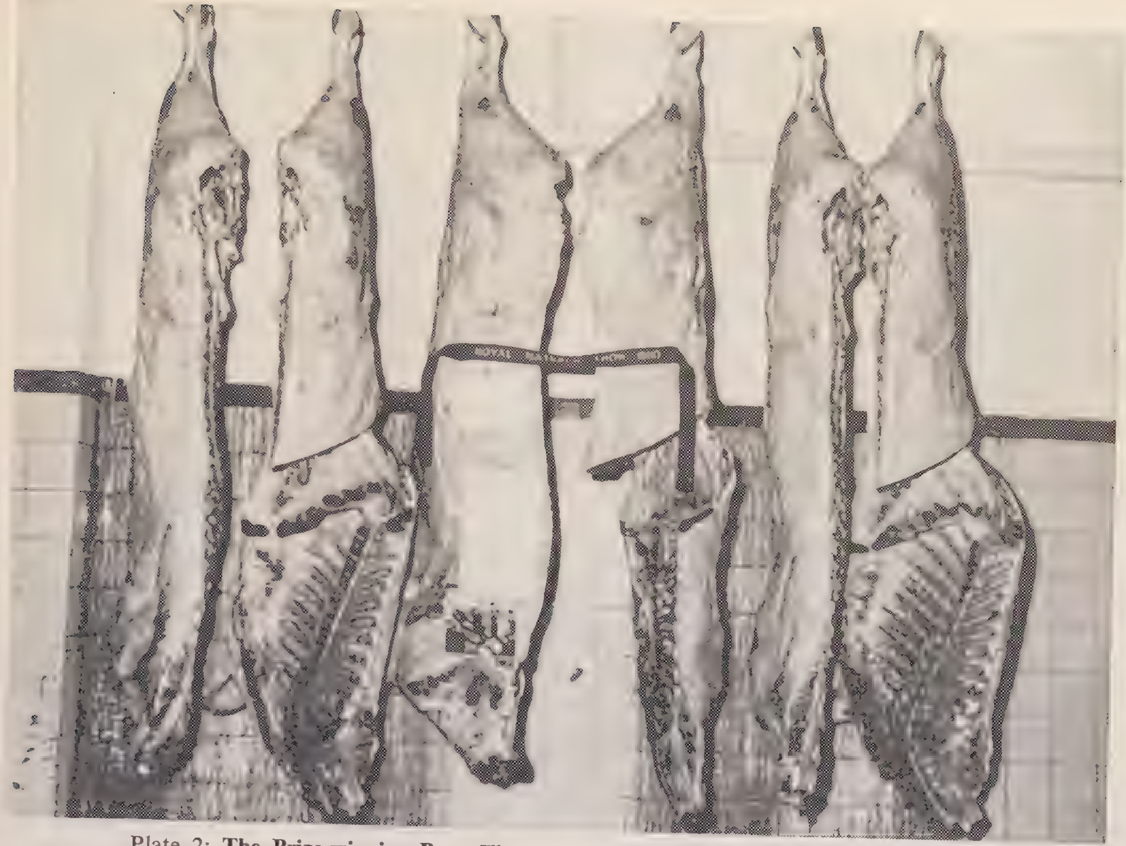

Plate 2: **The Prize-winning Pen.** They scored 301 points out of a possible 345.

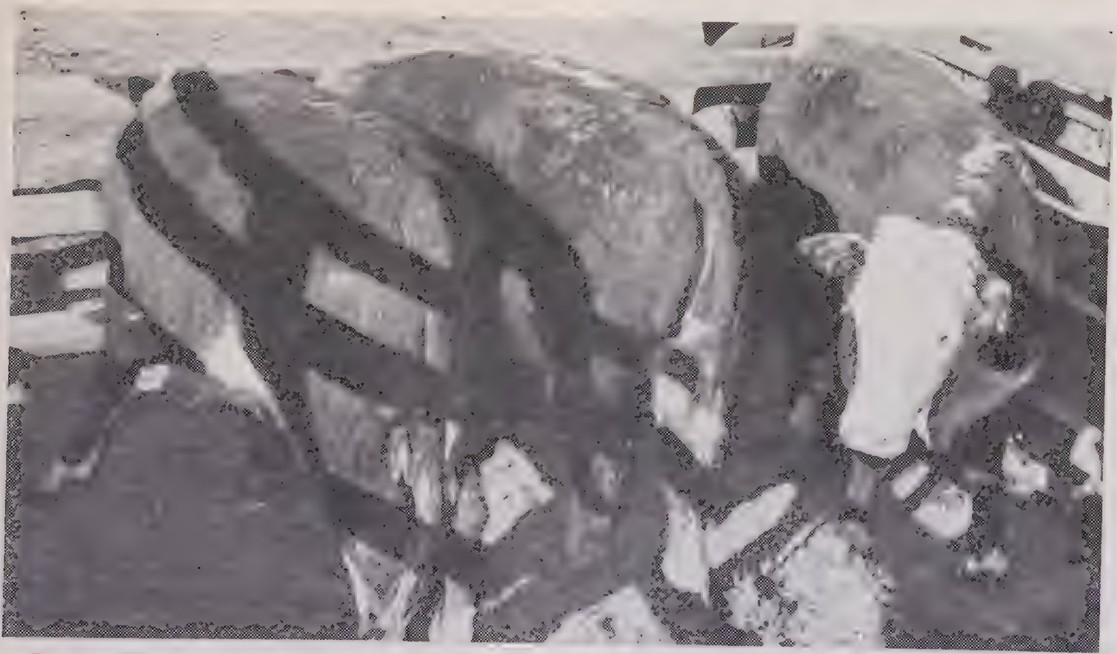

Plate 3: The Eventual Prize-winners in the Pen at the Showground Three Days before Slaughter.

Plate 4
This Part of the Entries Shows the General High Quality of the Whole Class.

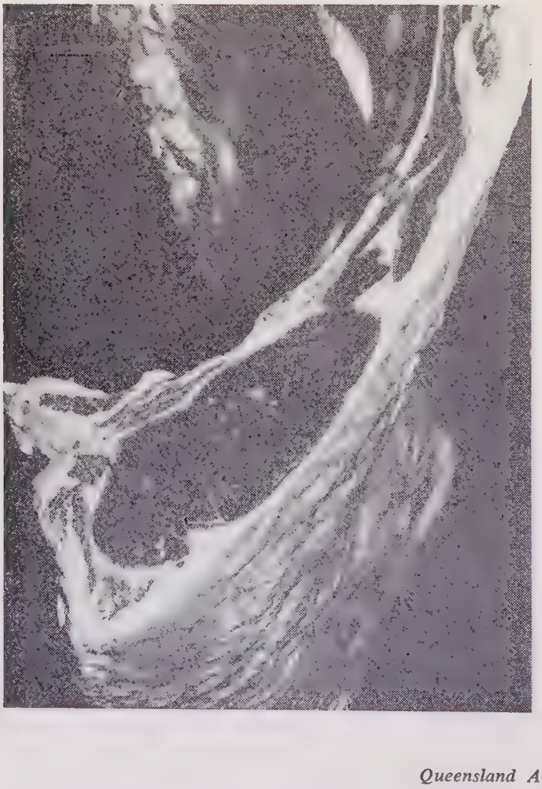

Plate 5
The Fat Cover in this Cut Between the Twelfth and Thirteenth Rib was close to the Judge's ideal for Local Trade Requirements.

Testing Market Milk For Bacteria

By V. R. SMYTHE, Senior Bacteriologist,
and W. C. T. MAJOR, Dairy Technologist.

Dairy farmers supplying market milk should study these reasons why the roll-tube bacterial counting method is used to test raw milk for bacteria.

For many years in Queensland the methylene blue test has been the legally accepted method of grading raw milk. The test still applies and the standards laid down under the Food and Drug Regulations have to be complied with. However, the emphasis which has been placed on the methylene blue test has resulted in a progressive build-up in the count of heat-resistant organisms in market milk supplies. This build-up took place steadily over a period of more than a decade and resulted in the bacterial counts of bottled pasteurised milk greatly exceeding the standard of 50,000 organisms per millimetre. This position was brought about by a number of factors of which the following are important:

(1) The methylene blue test is not a measure of numbers of bacteria surviving pasteurisation, and correlates poorly with the bacterial counts resulting.

(2) The methylene blue test is very greatly affected by storage conditions of the milk subsequent to production and would seem to be more a measure of atmospheric temperature than conditions of milk production on the farm.

(3) Farmers were quickly able to adjust their methods of milking-shed hygiene to produce milk which would satisfy the requirements of the methylene blue test. This could be done by the introduction of a system of sanitation which would destroy the weakly-resistant, highly-reactive types of organisms which would affect the methylene blue test, and at the same time leave untouched the slowly-reactive, highly-resistant types which form the bulk of the thermoduric population.

With these points in mind, a concentrated programme was commenced early in 1956, having as its aim the steady reduction in the thermoduric count of market milk supplies. Some four years have elapsed since this programme was commenced and this article advises on the nature of the problem and the progress which has been made.

Thermoduric Bacteria

The word "thermoduric" means resistance to heat, and in market milk work the term is applied to those organisms which will withstand the heating of pasteurisation. It is known that they make up the greater part of the numbers of bacteria occurring in pasteurised milk. They are of many types which vary widely in their individual characteristics. Their resistance to heat is only partial and all except those which form spores are destroyed by temperatures of 90 to 100 deg. C. (194 to 212 deg. F.), that is, temperatures up to boiling point.

Origin

The true origin of most of the thermoduric types is the cow's udder and in particular the teat canal. For this reason, the rejection of the first few streams of milk from each teat is often important in reducing the numbers of thermoduric organisms in milk. Nevertheless, the numbers of these organisms present in freshly drawn bulk milk is usually not large enough to cause concern. Their numbers, however, build up very greatly on improperly cleansed and sterilized equipment which then heavily contaminates the milk. In other words, milk equipment provides the most important immediate source of thermoduric bacteria while the cow's udder is the original source. This explains why equipment which has been thoroughly cleansed and sterilized to yield low-count milk will steadily become a source of contamination with thermoduric organisms if the cleansing and sterilizing methods become inefficient.

The build-up of numbers of thermoduric organisms on milk equipment takes place gradually. Where cleansing is inefficient or deposits build up on equipment, inoculation with thermoduric bacteria from the udder occurs at every milking. If the sterilization procedures are inadequate the weakly, resistant types tend to be destroyed leaving the more resistant thermoduric types. Thus the methods of hygiene may be selective in their action resulting in a progressive build up in numbers of thermoduric bacteria. This is important because it means that high counts of thermoduric bacteria do not result from an occasional lapse in milking shed hygiene but rather from some fault or faults constantly repeated.

High counts of thermoduric organisms have been found to occur as a result of contamination from both metal and rubberware. In the case of metal equipment such as pipelines, releaser, cans, vat and cooler, large numbers of thermoduric bacteria are commonly associated with the build-up of milk or water deposits resulting from improper cleansing techniques. Such deposits, however, are capable of being sterilized and not all plants which contain deposits produce high count milk. On the other hand, rubberware in an unsatisfactory condition almost invariably results in milk of high thermoduric count. The frequency with which cracked or fat-soaked rubberware has been found to cause high-count milk suggests that this source is the most important single contributing agency on Queensland dairy farms.

Contamination of milk from water or other external sources has not been found to contribute to high thermoduric counts.

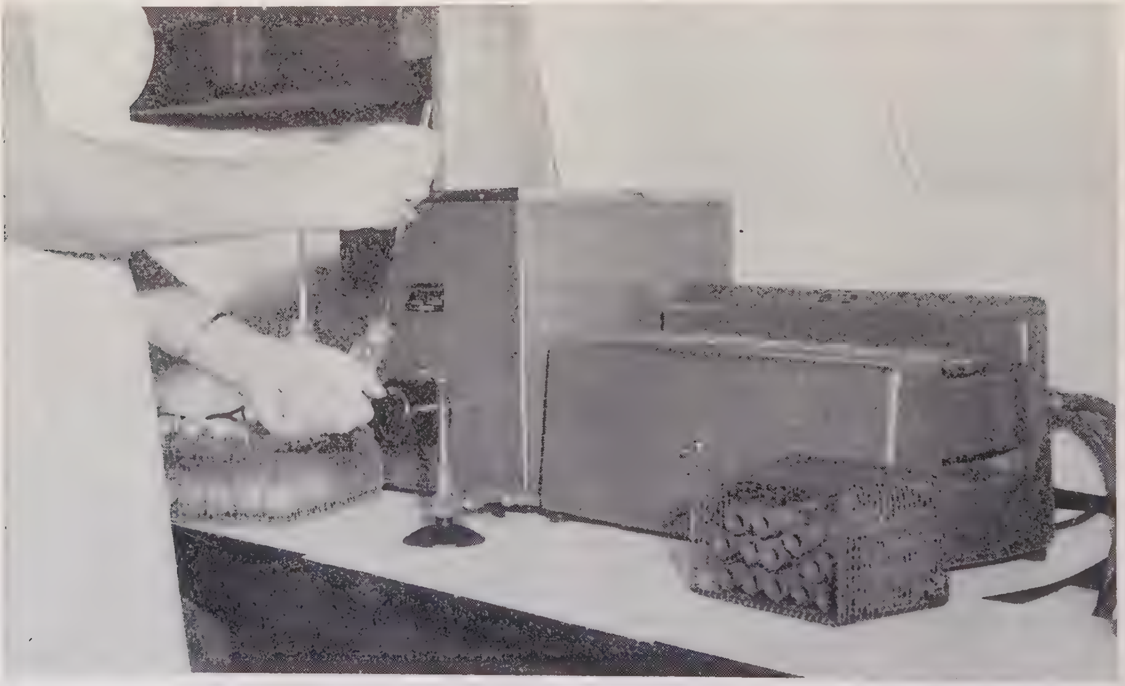

Plate 1

The Thermoduric Count Being Carried Out on Samples of Milk. The laboratory technician is in the act of inoculating media with milk by means of a standard loop.

High Thermoduric Counts

High counts of thermoduric organisms in milk are evidence of heavy contamination of the product and are consequently undesirable. Such high counts, however, have a deeper significance. Where the standards for milk as set down in legislation prescribe a maximum bacterial count per millilitre, high bacterial counts may cause the milk to fail the standard and lead to rejection. High thermoduric counts in raw milk result in high bacterial counts in the pasteurised product and may lead to its failing the standard laid down. In most States of the Commonwealth, a maximum bacterial count of 50,000 per ml. is prescribed for pasteurised milk. While many milks have failed this standard, there has sometimes been a reluctance on the part of legislative authorities to take action. The important point in this regard is that while high counts in milk are condoned little effort will be made to reduce them.

In the past, it has frequently been assumed that thermoduric organisms in milk are inert types having no significance on pasteurised milk. However, recent investigational work carried out in Queensland has shown that these bacteria can have a significant effect in reducing keeping quality particularly following raw milk storage. With the tendency towards longer storage of milk this aspect assumes greater importance.

There is yet another reason for attaching importance to high thermoduric counts. This results from the fact that the methylene blue test is not a satisfactory test for discerning the conditions of milk production on farms, especially during cool weather. There is usually no relationship between the methylene blue test of milk and the numbers of thermoduric bacteria present. The evidence available that these numbers arise as a result of improper sanitation on farms is irrefutable and it is logical therefore that the thermoduric count should be regarded as a more reliable guide to farm sanitation than the methylene blue test.

Reducing Thermoduric Counts

The results of tests have been forwarded to the suppliers concerned together with suitable advice as to methods of correction.

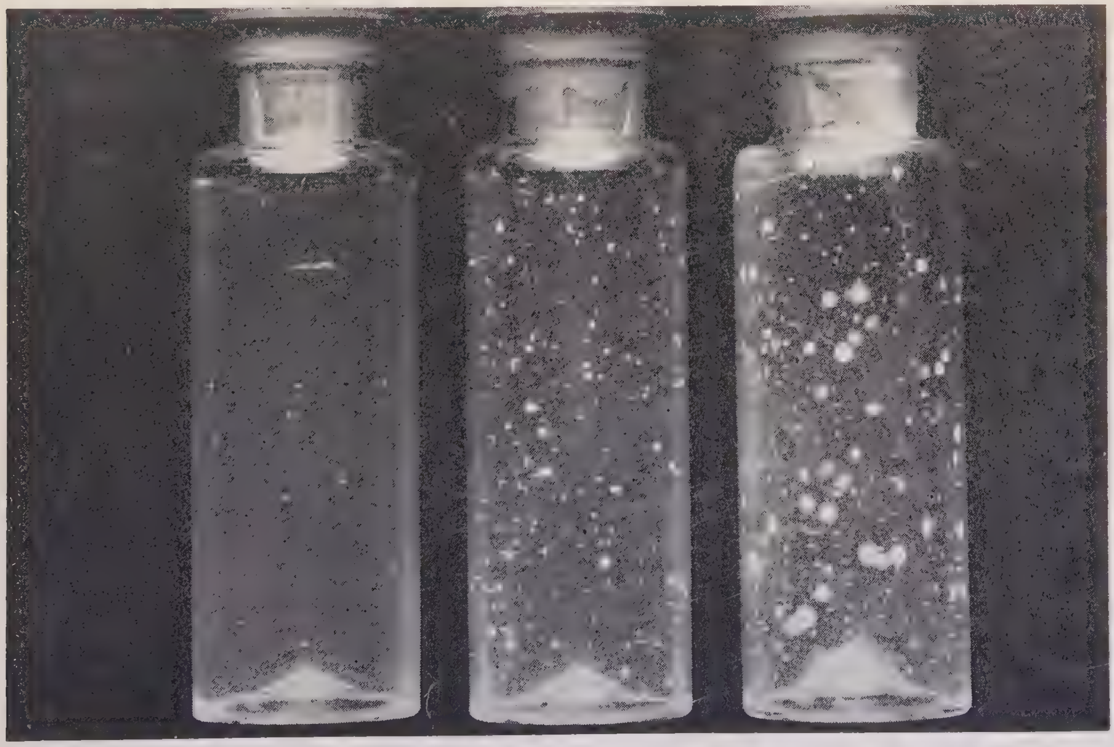

Plate 2

Roll Tubes Showing Colonies of Thermoduric Bacteria in Good, Poor and Unsatisfactory Milk.

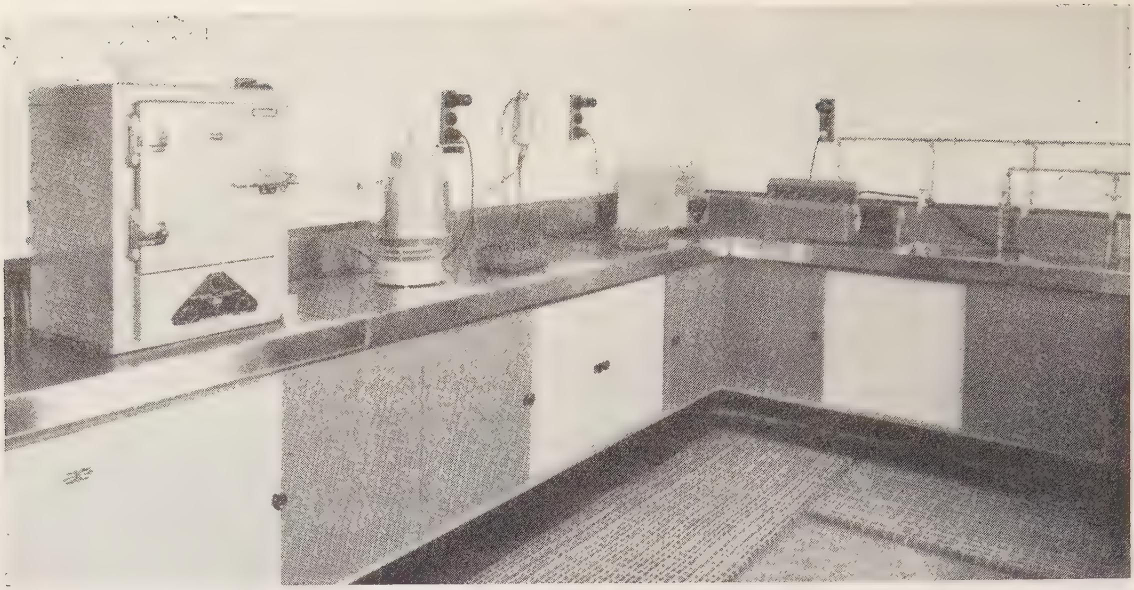

Plate 3

A Typical Laboratory Established in a Country Milk Chilling Factory for the Carrying Out of Milk Testing.

Because of some error inherent in the testing procedures little cognisance can be taken of the result of a single test, and no action is contemplated until the results of three tests are available. A standard of 30,000 thermoduric organisms per ml. has been set for the work. In the event of a supplier forwarding milk with counts in excess of the standard for three occasions, more strongly worded advice is sent. Further breaches of the standard are followed by punitive action in the nature of suspension of supply by the Milk Board or the factory management concerned.

As in all work of this kind, the results of laboratory testing have to be supported by field advisory work aimed at educating the farmer in the ways of producing low count milk. Before this could be done, however, a considerable amount of field work by laboratory officers was carried out in an endeavour to trace the causes of the high thermoduric counts experienced and to guide field officers in their advisory work on offending farms. It is interesting to report that whilst this work has confirmed that deposits of milkstone and waterstone on milk equipment are a common source of thermoduric organisms another factor is even more important. This is the condition of the rubberware used on farms. If the rubberware is not properly cleansed, it quickly becomes swollen and fat-soaked and may become cracked and broken also. In such a state, it has been found to contribute more thermoduric organisms than any other single source. The other important factor revealed by the investigation is the temperature of sterilization of equipment. This is probably the most critical operation carried out in farm sanitation. Where temperatures of sterilization have been kept very high, that is *boiling point,* the effective control of thermodurics has been achieved even on farms where the condition of cleanliness has been considered to be substandard.

In the Greater Brisbane area the proportion of milk received in bulk in tankers has steadily increased and the proportion received as direct supply has decreased correspondingly. Because of this, much attention has had to be paid to the thermoduric counts of chilled tanker milk. Consequently, the testing of such milk has been carried out regularly. In addition, the thermoduric count of chilled tanker milk has served as an index of the efficiency of the thermoduric testing scheme as applied to the individual farm supplies at the point of factory intake. It has been noteworthy that where factories have installed their own laboratory testing facilities and have placed great importance on the test result the thermoduric count of the tanker milk supplied to the Brisbane area has been steadily reduced.

Results Achieved

The results achieved from this work have been steady rather than spectacular. The regular testing has resulted in a steady decrease in the counts of bottled pasteurised milk throughout the State. This reduction has been directly related to the amount of importance which has been placed on the thermoduric testing in the various milk areas. For example, some milk pasteurising plants are still marketing bottled pasteurised milk with quite high bacterial counts, while others are regularly marketing bottled milk with a count which does not exceed the standard laid down.

The influence which the work has had in reducing the bacterial counts of pasteurised milk in Queensland is shown in Plate 4. It will be seen that over a four-year period the number of milks with counts in excess of 300,000 per ml. decreased from more than 50 per cent. to less than 10 per cent. At the same time the percentage of milks with counts from 50-100,000 per ml. has increased from almost nil to approximately 25 per cent. In addition during the last year some 5 per cent. of milks complied with the standard of 50,000 organisms per ml.

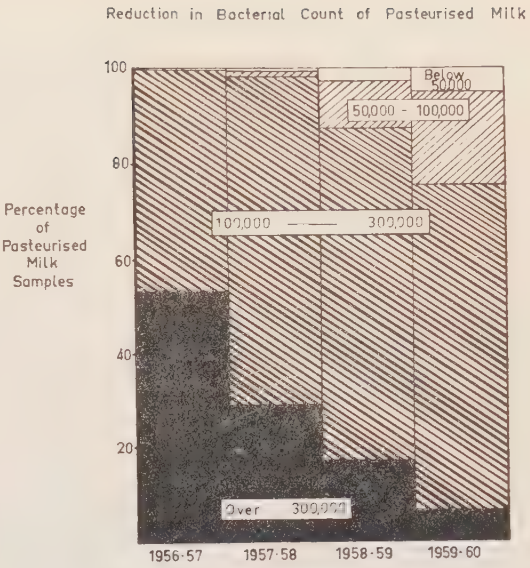

Plate 4

Another important but more obscure feature of the results has been the improvement in keeping quality imparted to the pasteurised milk by the reductions in count.

Poll Shorthorn Cattle Bred by Mr. C. M. Counsell at his "Prestbury" Stud, near Cambooya.

Mr. Counsell has been very much aware of the value of fodder conservation as a means of providing a supplementary diet and overcoming a drought. At mid-winter he had a reserve of 20,000 bales of lucerne hay.

Sire Surveying

By C. H. CLARK, Technologist.

Sire surveys are made each year on bulls owned by members of herd recording groups. The surveys contain information which gives an indication of the worth of the bulls in terms of production ability. They contain the prooduction records of the daughters of the bull, and comparisons are made with the records of other animals in the herd of the same age groups.

To indicate how the bull's daughters compare with the other cows in the herd the records of 2-year-old and 3-year-old animals are corrected to a "mature" basis and comparisons are made. When making comparisons the number of daughters is taken into consideration. The final result is then expressed as a "rating". A plus rating indicates that the bull is raising the production level of the herd. A minus rating shows that the yield of the female progeny of the bull is below the expected level of production and he is lowering herd production. When a bull is maintaining the production of the herd he has a "nil" rating.

A recent survey is discussed in detail. This will assist group members in interpreting and applying results of their own herds. It will also indicate to producers who are not recording their herds the value of examining the production ability of the herd sire.

Stages of Survey

Surveys are issued in four stages according to the number of daughters which have completed lactations. The stages are as follows:

- (*a*) *Private.*—These are prepared on request when at least six daughters have completed one lactation.
- (*b*) *Preliminary.*—This stage is issued when at least 10 daughters have completed one lactation.
- (*c*) *Intermediate.*—An Intermediate survey is issued when at least eight of the daughters in the preliminary survey have completed a second lactation.
- (*d*) *Final.*—This is the most detailed survey and is issued when three or more lactation records are available for at least six daughters.

A preliminary Survey of a bull whose daughters completed lactations during the 1958-59 recording year is depicted in Table 1.

TABLE I

PRELIMINARY SIRE SURVEY

Sire : Inglewood Baron
Breed : A.I.S.

Sire : Texas Red Chief
Dam : Inglewood Sue

Year	Maturity Equivalent Average Production of Recorded Daughters						Maturity Equivalent Average Production of other Animals in the herd						Rating of Sire
	Dtrs.	Lacts.	Milk	Fat	Test	Days	Cows	Lacts.	Milk	Fat	Test	Days	
1958–59	14	14	5,337	276	5·2	289	39	39	5,830	302	5·2	298	−12

Year	Particulars of Daughters						Particulars of Other Cows					
	Age	Rec. No.	Milk	Fat	Test	Days	Age	No.	Milk	Fat	Test	Days
1958–59	2	11	3,825	205	..	300	..	..	..	..	..	..
	..	14	4,035	208	..	300	..	..	..	..	..	..
	..	5	5,475	256	..	270	..	..	..	..	..	..
Average	..	3	4,445	223	5·0	290	2	2	4,560	245	5·4	300
	3	76	2,505	135	..	240	..	..	..	..	..	..
	..	57	4,590	235	..	270	..	..	..	..	..	..
	..	61	5,325	274	..	300	..	..	..	..	..	..
	..	12	5,205	285	..	300	..	..	..	..	..	..
Average	..	4	4,406	232	5·2	277	3	6	5,388	273	5·1	285
	4	48	4,380	211	..	300	..	..	..	..	..	..
	..	25	5,040	246	..	300	..	..	..	..	..	..
	..	47	4,950	262	..	300	..	..	..	..	..	..
	..	50	4,680	272	..	300	..	..	..	..	..	..
	..	8	5,775	295	..	300	..	..	..	..	..	..
	..	49	4,455	226	..	270	..	..	..	..	..	..
	..	74	5,700	307	..	300	..	..	..	..	..	..
Average	..	7	4,997	260	5·2	296	4	8	5,100	265	5·1	292
	M	Nil	..	..	..	..	M	23	5,700	296	5·2	298

Examining the Survey

Besides showing the particulars of the bull, the survey is presented in two portions. The first part shows the "maturity equivalent" average production of the bull's daughters, and the average production of other cows in the herd after corrections for age have been made. This provides a direct comparison between the average production of the daughters and that of the other cows. In this case the bull's daughters are producing 26 lb. butterfat less than other cows in the herd. When an adjustment to this figure is made according to the number of daughters in the survey we give the bull a rating of —12. Therefore, if records have been made under similar conditions, the bull is *lowering herd production.*

In the second part of the survey the production of individual daughters is listed according to the age of each animal. An average production is calculated for each age group, and an average production of other animals in the herd in the same age group is included so that comparisons may be made. The purpose of this portion of the survey is to permit perusal of each daughter's record and note the ranges in each age group. It also confirms the first portion of the survey if sufficient records are available for comparison in the various groups. From Table 1 it is seen that the production of the daughters of the bull is lower than that of other animals. It may be noted also that the ranges of production in each age group are wide. In the 3-year-old records cow No. 76 produced 135 lb. butterfat while cow No. 12 produced 285 lb. of butterfat—a difference of 150 lb.

Using the Survey

Besides showing that the daughters of the bull are lowering herd production, the preliminary survey indicates that it would be unwise to use a son of this sire or another closely related bull from the same herd.

Although a bull may have been sold before the survey results are available, they are still useful as they provide information for the selection of future sires.

Factors Influencing the Survey

Each survey is compiled according to information included on the "Application for Sire Survey". The conditions under which records were made have not been taken into account except for notings of sickness, and so on, which have been placed on the Herd Recorder's Record

Sheet. Varying feeding conditions or months of calving have not been considered. Records of all cows which were dry from 30 to 90 days after calving have been excluded. The factors which may affect production reslts are:

(*a*) *Treatment before Calving.*—Sometimes the daughters of the bull may have calved in poor condition, and their first lactations have been affected. Incorrect comparisons will therefore result if all cows of similar age have not been treated similarly before calving.

(*b*) *Month of Calving.*—An analysis of herd recording information has shown that cows calving in the second, third and fourth quarters of the year produce better than those which calve in the first quarter of the year. Comparisons will not be valid if differences due to month of calving are not taken into account.

(*c*) *Period between Calvings.*—The period between calving and length of dry period of the animals compared could influence the result of a survey. When the period between calvings is less than 12 months the production during the following lactation could be lowered. Surveys indicate that a cow should be given a dry period of at least 6 weeks under good feed conditions if maximum production is to be expected during the following lactations.

Merit Stud Register For Dairy Herds

By S. E. PEGG, Chief Adviser, Herd Recording

A Register of Merit for stud herds has been introduced, its purpose being to indicate to dairy farmers the stud herds in which a high percentage of the cows is entered in the Register of Merit for Dairy Cows. It also indicates those herds where there should be a number of sons of merit cows available for sale.

The qualification for entry into the Merit Stud Register is that at least 40 per cent. of the cows over 4 years at the end of the recording year shall be entered in one of the sections of the Register of Merit for Dairy Cows. There is a stipulation that the minimum number of animals shall be 6.

A herd which qualifies is entered in the Merit Stud Register for one year only.

The herds which have qualified for the year ending June 30, 1960, are listed in the following table:

MERIT STUD REGISTER—1960

Breed	Stud	Name and Address of Owner	No. of Merit Cows		
			Elite	Lifetime	Intermediate
A.I.S.	“ Bantry ”	C. Sullivan, Pittsworth	..	5	17
A.I.S.	“Faimoye“	C. K. Roche, Warwick	..	9	5
A.I.S.	“ Kenstan ”	T. W. Fowler, Pittsworth	..	4	14
A.I.S.	“ Sunny View ”	J. Phillips & Sons, Kingaroy	3	7	9
A.I.S.	“ Valera ”	Sullivan Bros., Pittsworth	..	6	4
Ayrshire	“ Inverell ”	B. Goddard, Mount Tyson	..	2	5
Guernsey	“ Woowoonga ”	A. Ruge & Sons, Biggenden	..	2	11
Jersey	“ Brook Lodge ”	H. M. Waite, Laidley	..	6	5
Jersey	“ Yarallaside ”	R. S. & G. C. Postle, Pittsworth	..	1	12

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This Dress is of Sheer Worsted Wool in Yarn-Dye Grey with Midriff Interest in Lighter Grey Touched with Red.

Both Dress and Hat of this Handsome Outfit Use a Light Weight Wool in Houndstooth Check for the Bodice and Pocket Detail and a Solid Colour for the Skirt.

Botany for Farmers

Although compiled in the first place for beekeepers, "The Honey Flora of South-Eastern Queensland" has a use for farmers and others interested in botany. It contains illustrations and descriptions of the important ironbarks, gums, bloodwoods, boxes, stringybarks, wattles, tea-trees, and cultivated plants such as lucerne, pumpkins, oranges and clover.

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Plate 1: **Karen Davey shows interest in Oranges at Redlands Experiment Station.**

Citrus Diseases In Queensland—1

By B. L. OXENHAM, Senior Pathologist.

This article is divided into three parts, to appear in three issues of the Journal. The first part deals with diseases affecting the citrus fruit.

There are a number of diseases and fungal blemishes which affect citrus fruits. Some cause unsightly marking of the rind, others result in rotting of the rind and decay or tainting of the pulp. In several cases the foliage is also affected, but the fruit damage is the most important phase.

These diseases may be controlled by a carefully applied spray schedule, by post-harvest fruit treatment and by a system of hygiene both in the orchard and the packing shed. For spraying to be really effective it must involve the following principles: correct choice of materials; use of the right concentrations; adequate mixing; proper timing, and thorough coverage of the trees. A spray programme for citrus disease control is given on page 73.

The following key may help growers to diagnose their particular disease problems:

1. Small sunken spots on fruit ripening in warm to hot weather. Exposed fruit on northern side of trees affected first	**Black spot**
2. Brown to black rough, sandpapery surface blemish on fruit and foliage	**Melanose**
3. Raised grey to brown corky scabs on fruit and leaves of lemons and some mandarins	**Scab**

4. Sunken, round, brown spots on fruit of Emperor mandarins . .	**Brown spot**
5. Soft decay of the fruit covered by white fungal growth and green or blue dusting of spores	**Green and blue moulds**
6. Brown rot extending from the button of the fruit	**Stem end rot**
7. Collapse of rind tissues with slight cracking and wrinkling of the surface	**Rind breakdown**
8. Black, sooty fungal deposit on surface of fruit and leaves . .	**Sooty mould**
9. Fine smoky growth on surface of fruit with small black clumps of fungus mycelium . .	**Fly speck**

Black Spot

Black spot is a serious disease of early or late citrus varieties which mature their fruit in the warmer weather; lemons and Late Valencia oranges suffer the worst damage.

The disease is caused by infection of the young fruits with a fungus, *Guignardia citricarpa,* which spreads largely from the fallen leaves. Once the rind of the fruit is infected the fungus lies dormant until the onset of ripening. If the weather is warm to hot at this time, spotting of the rind occurs. It is first seen on the exposed sides of the fruits growing on the warm, northern side of the tree. Spotting may also develop after harvest.

Three types of spotting may be seen, depending on the stage of maturity of the fruit and the prevailing weather conditions. The first consists of firm round, brown, slightly sunken spots about an eighth of an inch in diameter. They have a dark rim and a grey centre. Small black fungal fruiting bodies may be seen in the centres of the larger spots (Plate 1). These particular "hard" spots do not usually develop further.

The second type is seen as numerous small, reddish-brown to brown sunken spots on the rind surface. These spots are "soft", the fungus is still active in them and they may spread quickly into a serious blemish. The third type is a large, spreading, brown lesion with a dark centre. It may cover a large area of the fruit in a few days and cause considerable fruit fall.

A brown freckling of the skin of the fruit may sometimes occur on green fruit if the late summer and autumn are abnormally hot and dry. Leaf spotting is also sometimes observed but is of no importance.

The fruit are susceptible from petal fall for a period up to 5 months depending on the age and vigour of the trees. The fruits on young, thrifty trees are susceptible for a shorter period than those on older, less vigorous trees. It is necessary to apply a spray schedule which will protect the fruit during the susceptible period.

Experimental work in Queensland has shown that spraying with cuprous oxide or copper oxychloride at half to three-quarter petal fall and 6 and 12 weeks later will control black spot. White oil plays an important part in the disease control and should be added to each spray at a strength of 1 gal. to 160 gal. of water unless it is being used at higher strengths as a scalicide.

With young, vigorous trees two copper-white oil sprays at petal fall and 8 weeks later should be sufficient.

Melanose

Melanose is another serious fruit blemish of citrus particularly in humid coastal districts. Orchards in inland areas also may be affected if the weather in spring and early summer is unusually wet. All varieties are susceptible with perhaps grapefruit showing the worst damage.

The disease is caused by a fungal infection, the causal fungus, *Diaporthe citri,* mostly spreading from dead twigs and branches. The fruit and foliage are only susceptible when they are very young, most fruit infection taking place within the first few weeks after petal fall.

The symptoms on twigs and leaves are seen as minute, round, raised, gummy lumps which are dark in colour and rough to touch. They may be present in large numbers, in which case the leaves are twisted and discoloured and may fall prematurely. On the fruit, the blemish is rather similar, being brown at first and becoming a darker brown as the fruit develops. The sand-papery appearance and feel serves to distinguish melanose from the dark brown blotching caused by maori mite attack.

The melanose spots may be arranged on the fruit in various patterns such as circles and "tear stains" (Plate 2). If the spots are so dense as to form a crust, this scar tissue later cracks to give a "mudcake" effect. Fruit so affected are restricted in development.

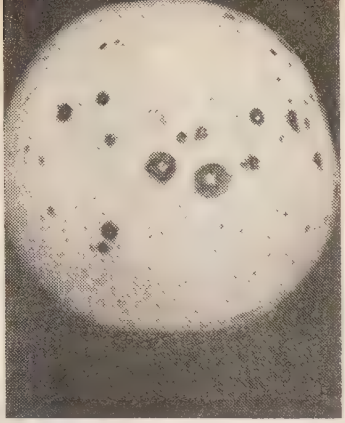

Plate 2: **Black Spot on Orange Fruit.**

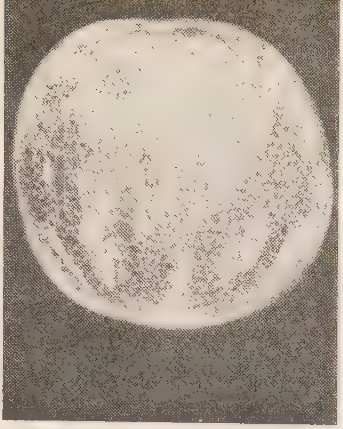

Plate 3: **Melanose on Orange Fruit.** Note the "tear streaks".

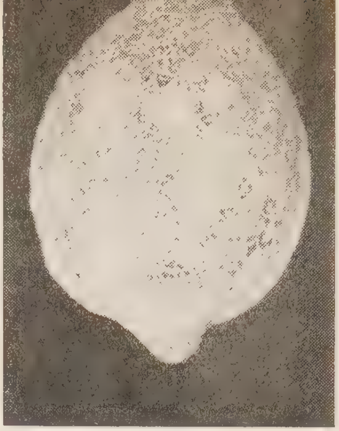

Plate 4: **Scab on Lemon Fruit.**

The spores of the fungus are spread by splashing or dripping water; hence the infection patterns on the fruit formed by drops or streaks of moisture carrying the spores.

Control measures consist firstly of pruning out all dead twigs and branches during the winter. These prunings should be carried away and burnt. Good cultural treatment and efficient pest control will of course reduce the amount of dead wood produced.

Spraying with cuprous oxide or copper oxychloride and white oil at half to three-quarter petal fall will protect the young fruit from infection. If flowering is prolonged, or the season is very wet, two half-strength sprays, one at the normal time and the other 2 to 3 weeks later may be necessary for good control.

Scab

Scab is a disease affecting lemons and some varieties of mandarin such as Beauty of Glen Retreat. It is caused by the fungus, *Sphaceloma fawcettii,* and attacks both the young foliage and fruit. Raised, grey to light brown corky scabs are produced on the twigs, leaves and fruit (Plate 3). Affected leaves are often distorted with raised "pockets", each tipped by a scab lesion. Lemon fruits may have bumps and knobs on the surface with scabs surmounting them.

Apart from being a serious fruit blemish of susceptible varieties in humid areas, scab also causes severe distortion of some nursery stocks. The rough lemon is often severely distorted and difficult to bud.

A single copper-white oil spray at half to three-quarter petal fall will protect the fruit against scab. Spray schedules for black spot or melanose control will therefore also prevent this disease. In the nursery the susceptible trees should be sprayed at the commencement of each growth flush.

SPRAY SCHEDULE FOR BLACK SPOT, MELANOSE AND SCAB

Disease	Time	Fungicide
Scab . . . . . . (Susceptible varieties)	½–¾ petal fall	Cuprous oxide‡ plus white oil, or Copper oxychloride plus white oil
Melanose* . . . . (All varieties)	½–¾ petal fall	Cuprous oxide‡ plus white oil, or Copper oxychloride plus white oil
Black spot . . . . (Susceptible varieties)	½–¾ petal fall†	Cuprous oxide‡ plus white oil, or Copper oxychloride plus white oil
	6 weeks later	Cuprous oxide‡ plus white oil, or Copper oxychloride plus white oil
	12 weeks later	Cuprous oxide‡ plus white oil, or Copper oxychloride plus white oil

* Two half-strength sprays at petal fall and 2 to 3 weeks later may be substituted if season is wet or flowering prolonged.

† Young vigorous trees may only require two sprays timed at petal fall and 8 weeks later.

‡ Home-made cuprous oxide is used at 3 gal. to 40 gal. of water ; commercial cuprous oxide at 1 lb. to 40 gal. and copper oxychloride at 1½ lb. to 40 gal. White oil should be added to the fungicide at the rate of 1 gal. to 160 gal. of water or at a higher rate if being used for scale control.

Brown Spot

In Queensland, brown spot causes damage on only one commercial variety of citrus, the Emperor of Canton mandarin. Similar symptoms have also been noted on kumquats. The disease is restricted to the Howard-Burrum, Palmwoods and Elimbah districts and in wet seasons can cause severe damage to the Emperor mandarin crops in these areas.

A bacterium has long been suspected as the cause of brown spot but research work has so far failed to locate the exact cause.

The young foliage is often first affected, and black, water-soaked dots appear on the twigs and leaves. The spots on the foliage are often restricted to the leaf edges, and there is a tendency for the leaf tissue to curl around the lesions or damaged areas. There may be considerable leaf fall and blighting and blackening of the young twigs.

On the fruit, the symptoms consist at first of small brown, sunken spots which may enlarge up to a quarter of an inch in diameter. The centre of these larger dark spots is often slightly raised into a pimple. Some small spots do not extend, however, and may dry up, leaving a cracked scar. The active lesions cause premature colouring and fruit fall, and even if the affected fruit remains on the tree it usually has an off-flavour.

Research work in Queensland has not produced a spray programme which will control brown spot completely. The disease may be greatly reduced, however, by spraying with a copper-zinc mixture at bud burst in the spring, then at petal fall, and in November and January. The copper component in the spray may be cuprous oxide or copper oxychloride. Zinc sulphate is first neutralised with caustic soda in water at the rate of 2 lb. zinc sulphate, 9 oz. caustic soda and 40 gal. of water. The copper fungicide is then added.

It has been noted in orchards where a suitable spray programme for brown spot control is used, that the disease control improves progressively over the years. Apparently there is a cumulative effect in reducing the source of infection.

Green and Blue Moulds

Green mould, *Penicillium digitatum,* is more common in Queensland than blue mould *Penicillium italicum.* It produces a soft, light-brown water-soaked rotting of the fruit, which soon becomes covered with a white fungal growth and then a dense pale green mass of spores (Plate 4).

These spores are formed in huge numbers and are readily blown about to infect damaged fruit. The main infection occurs after picking, in the packing sheds, colouring rooms or in transit and storage. If fruits become mouldy on the tree it is an indication they have been damaged by thorns or insects such as fruit fly.

The infection takes place mainly through injuries although many of these are so small as to be not readily visible. Infection can spread from fruit to adjacent fruit in the packed cases. Green mould is most common in wet, humid weather when the fruit are turgid and easily damaged, and conditions are ideal for spread of the fungus. Soft fruits such as Emperor mandarins are very prone to infection.

The first point to be remembered in preventing mould is care in handling the fruit, particularly in humid weather. The fruit should be double-clipped and not pulled, and placed not dropped into the containers. Field boxes and graders should be smooth and free of protruding nails and splinters. General handling should be kept to a minimum and when necessary should be gentle.

Having reduced the sites for infection it is then important to likewise reduce the sources of infection. Rejected or rotting fruit should be removed well away from the packing shed every day to lower the spore load in the shed. Brushes, graders, field boxes and shed should be treated regularly with 2 per cent. formalin or a solution of sodium ortho phenyl phenate (½ lb. in 10 gal. of water).

Picking and handling when the fruit is wet should be avoided if possible. "Sweating" the fruit for a period before grading is also helpful. In a bad mould season it may be necessary to dip the fruit to prevent mould. "Phenate" treatment using the chemical sodium ortho phenyl phenate is the current treatment in large packing houses, but under Queensland conditions is difficult for any but the bigger orchardists. A conveyor belt system is required and the temperature and pH of the dip must be carefully adjusted.

It is practicable for the smaller grower, however, to use the borax bath method, in which 4 lb. borax and 2 lb. boric acid are dissolved in 10 gal. of water. A suitable wax emulsion is added, and the fruit is dipped, dried and then packed. If the fruit is being wrapped, diphenyl-impregnated wraps will also help to reduce infection.

Stem End Rot

Stem end rot may be caused by infection with either of two fungi, *Diaporthe citri* or *Diplodia natalensis*. In Queensland the former is by far the most common and causes a light-brown rot which extends through the rind from the stem end of the fruit (Plate 5). The rot also progresses through the core of the fruit and off-flavours develop in the flesh. The damage may occasionally be observed on the tree but most losses occur after harvest.

As the fungus, *Diaporthe citri,* causes melanose as well as stem end rot the control measures given for melanose will help to reduce the fruit rot phase. The disease is most prevalent in the crop from the older, less thrifty trees and this fruit should be picked as soon as possible after maturity. The younger, vigorous trees may be harvested later.

Dipping the fruit in a sodium salicylanilide preparation, such as "Shirlan WS", will reduce stem end rot in storage. If lemons are being stored they should be treated for half a minute in a dip containing 4 oz. of "Shirlan WS" to 10 gal. of water-wax emulsion; 24-D is also added to the dip at the rate of 500 p.p.m.

Rind Breakdown

Rind breakdown is caused by a breaking of he oil cells in the skin of the fruit. The liberated oil then causes a scalding of the surrounding issues. If the affected fruit are still green at the time of the injury, the damage is often called oleocellosis or oil spot. In this case the tissues around the oil glands are sunken and the affected patches remain green when the rest of the skin colours (Plate 6).

Lemons are most commonly damaged by oleocellosis. The injury to the oil cells may be caused by insects, thorns or by picking the fruit when they are turgid and damp.

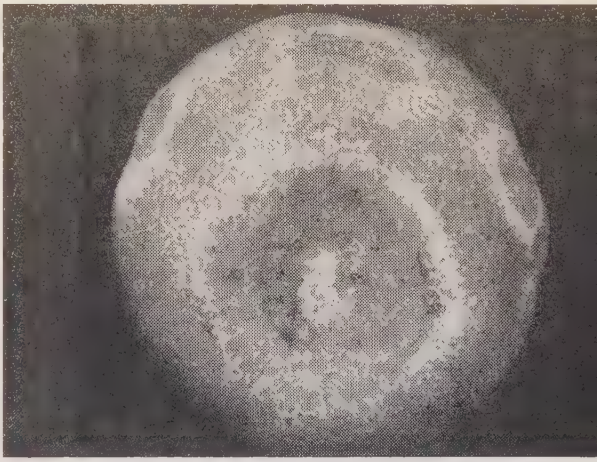

Plate 5: **Green Mould on Mandarin Fruit.**

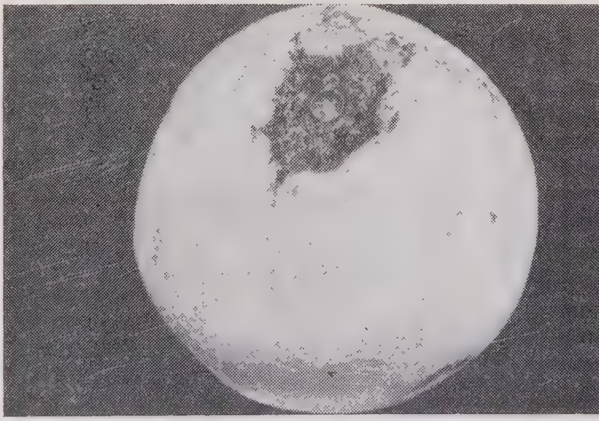

Plate 6: **Stem End Rot on Orange Fruit.** Early symptoms.

If the fruit are ripe or near ripe at the time of the injury, the rind becomes soft and flabby and then collapses with some cracking and wrinkling of the surface. With oranges and mandarins the areas of breakdown are usually a pale brown in colour, whereas in lemons they progress in colour from a mottled yellow to yellowish brown and then dark brown.

Rind breakdown in ripe fruit is normally most common in Emperor of Canton mandarins, Washington Navel oranges and Villa Franca lemons. It occurs usually after a period of showery weather or a prolonged period of heavy dews and high humidity. Fruit on the shady side of the tree are worst affected. When the rind is damp for a considerable period, it absorbs a large amount of moisture and this excessive moisture causes the rupturing of the oil cells. A drop in temperature after a rainy period accentuates the trouble. Placing damp, turgid fruit in the colouring rooms often causes a scalding of the rind which is similar to rind breakdown.

The damaged areas of the skin are rapidly invaded by fruit rotting fungi such as green mould. With varieties such as the Emperor, fruit fall is often considerable.

Rind breakdown can be reduced by picking the fruit of susceptible varieties as soon after it matures as practicable. Excessive applications of nitrogen fertilizer should be avoided because they are thought to increase the susceptibility of the fruit to the damage.

The fruit should not be picked when damp and turgid, and also should not be placed in colouring rooms when in this condition.

If rind breakdown has occurred in the crop, the fruit should be carefully culled and perhaps held a little longer than usual in the packing shed. The damaged fruit will then not be packed and cause losses from fruit rots in the cases.

Sooty Mould

Sooty mould is composed of a black fungal growth on the surface of twigs, leaves and fruit (Plate 7). This growth is produced by several fungi which feed on the "honey dew" or sugary secretions of aphids and various soft scale insects which infest citrus trees. The fungi are not parasites of citrus but merely grow over the surface of the plant tissues.

If the mould growth is thick it prevents sunlight from reaching the underlying tissues, but the most serious effect is the obvious blemishing of the fruit.

The most practical way of dealing with sooty mould is the efficient control of the insects which are the primary cause. When these insects are killed the fungus dries up and eventually disappears.

There are various ways of removing the mould from affected fruit after harvesting. Investigations at the Citrus Wastage Research Laboratory at Gosford, New South Wales, have helped to evolve effective, practical fruit-cleaning methods.

If the grader is fitted with scrubbing brushes, the fruit may be dipped before passing through the brushes in a solution of a detergent (containing sodium metasilicate) prepared at the rate of 3 oz. to 10 gal. of water. The solution should be lukewarm (90–100 deg. F.) and each 100 gal. of dip will treat 500 cases of fruit. For best results the brushes should be sprayed with lukewarm water as the fruit pass over. The fruit are then dried quickly before packing. The brushes and other equipment should be disinfected regularly with 2 per cent. formalin or sodium ortho phenyl phenate ($\frac{1}{2}$ lb. in 10 gal. of water). Soft-skinned varieties will not stand up to this scrubbing treatment.

If the fruit are not being scrubbed they should be dipped for 2 min. in a cold bath of sodium hypochlorite or chloride of lime. These baths are made up as follows:

1¼ gal. sodium hypochlorite
8¾ gal. water
1½ lb. boric acid

or

2½ lb. chloride of lime
10 gal. water
1½ lb. boric acid.

The sodium hypochlorite or chloride of lime is dissolved in the water first, and then the boric acid is added. If metal containers are used they should be protected by a bituminous paint and the fruit should be dipped in wooden crates because metal baskets will corrode. Rubber gloves should be worn to prevent injury to the hands. After dipping, the fruit is washed in clean water and dried before grading and packing. The polishing brushes on the grader should remove any remnants of the mould. Ten gallons of sodium hypochlorite solution will remain effective for about a week. The chloride of lime solution is cheaper to prepare but must be renewed every 3 to 4 days. The vat should be covered when not being used and should be situated in a cool part of the shed.

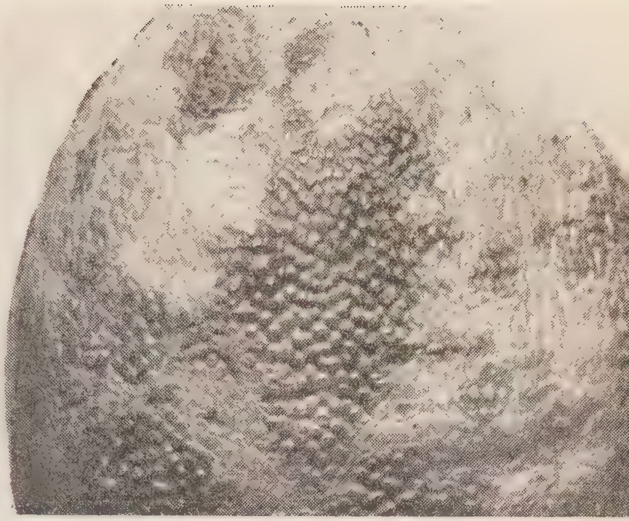

Plate 7: **Rind Breakdown of Citron Fruit.** Note the raised appearance of the oil glands.

Fly Speck

Fly speck is caused by a superficial fungal growth on the skin of the fruit. It may occur as a fine smoky web of fungal mycelium or as small round clumps or balls of fungus which give the name "flyspeck." The deposit may be rubbed off the rind as it does not penetrate the tissues. The fungus responsible, *Leptothryium* sp., thrives in damp, humid conditions, so it is found mainly in the wet, coastal citrus districts and particularly on the shaded parts of the tree.

The copper fungicidal sprays applied for the control of other diseases also help to check this fungus. If blemished fruit are present, however, washing and brushing as for sooty mould will also remove the fly speck.

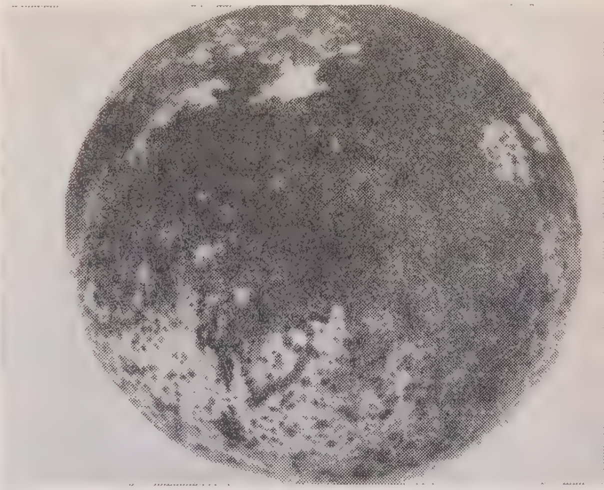

Plate 8: **Sooty Mould on Orange Fruit.**

Plate 1

Some of the High Producing Pure Bred Production Recorded Cows that have Replaced Low Producers on the Henderson Farm.

Dairy Farming To A Plan

By T. W. SMITH, Dairy Adviser, Dalby.

From petrol pumps to milk pumps is becoming a habit in the Bell area. Mr. Gordon Henderson is the second garage proprietor to take up dairying in the Bell district in the last few years and to attain outstanding success with the venture.

For 13 years Mr. Henderson and his son, Alec, conducted a garage business in Bell. In 1956, fire destroyed the premises and they decided on dairy farming as their next means of livelihood, so in July of that year they purchased their present property of 327 acres.

Knowing that success comes to those who are prepared to work for it, particularly when the objective is known and a definite plan laid down and followed until that objective is reached, they planned ahead.

Farm Plan

In 1956, when Mr. Henderson and his so took up this farm it consisted of two large gras paddocks, five smaller paddocks for cultivatio and the house paddock. (See Plate 2.)

Only one watering point meant a long wal for thirsty cattle.

This layout was unsuitable for efficient dairying. It meant time spent in mustering the her time and energy wasted by the cows in walkin to water, no possible chance of pasture management and consequently less pasture feed available

Herd management was also hampered as ther was no suitable paddock in which to keep th bull.

Plan 1.

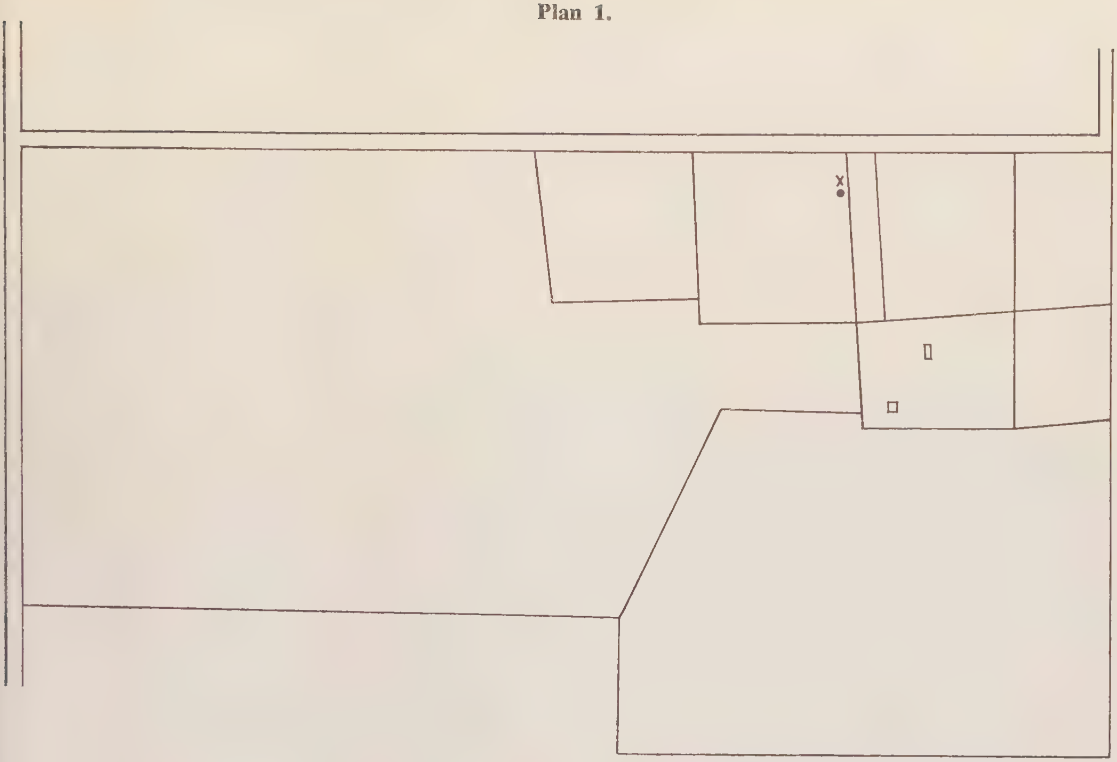

Plate 2

This was a problem which was tackled very arly and soon it seemed that fence posts were terally sprouting from the ground. It wouldn't eem like this to Mr. Henderson and Alec, as they ere the ones who were putting the posts there, ut to-day this farm has been subdivided into 8 paddocks, the largest of which contains 36 cres.

In addition to this there are now seven addi- onal watering points so that cattle have easy ccess to water in practically every paddock and lso at the dairy. This has meant the sinking of n additional bore and locating a tank to obtain ravity feed to some of these points.

The farm now appears as is shown in Plate 3; can be seen that further subdivision is planned.

Rotational grazing of these paddocks is now ossible. The bull paddock ensures that Gordon nd Alec Henderson are managing the herd. alves and weaners are kept handy where their rogress can be watched, and forward springers an be close at hand when calving.

There is still much to be done, but if this rate of progress is maintained there won't be much left to do after another 4 years.

Discussing the improvement effected, Mr. Henderson said, "Well, there is more to it than just the monetary return. There is the satisfaction, knowing what the farm was like when we took it over, and what it is to-day, and in having good cows properly looked after."

Herd Improvement

Mr. Henderson realised that farm and herd improvement go hand in hand. Whilst carrying out his plan for improving the farm, he also adhered strictly to a plan for herd improvement.

At the time of purchase the stock on hand were:

	37	milking cows
	19	mated heifers
	1	bull
Total	57	

Plan 2.

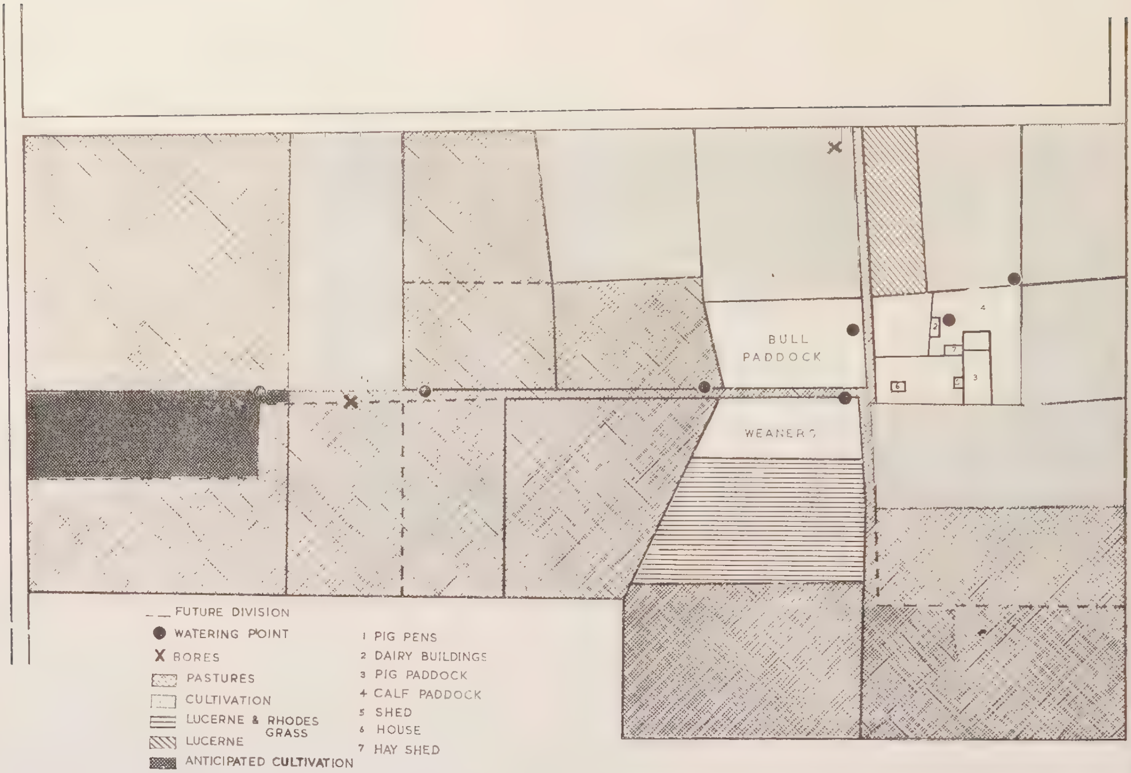
BULL PADDOCK
WEANERS
1
2
3
4
5
6
7
FUTURE DIVISION
WATERING POINT
BORES
PASTURES
CULTIVATION
LUCERNE & RHODES GRASS
LUCERNE
ANTICIPATED CULTIVATION
1 PIG PENS
2 DAIRY BUILDINGS
3 PIG PADDOCK
4 CALF PADDOCK
5 SHED
6 HOUSE
7 HAY SHED

Plate 3

It soon became obvious to Mr. Henderson that the milking cows were such in name only as, compared with neighbouring herds, production was very low.

The objects and benefits to be obtained from herd recording were explained to him and in October of the same year production recording of the herd commenced.

In that recording year and the following one, herd production figures were below the group average.

With limited capital it was not possible to discard all the low producers and purchase better stock immediately, but a careful eye was kept on the cattle market.

"Tinner" prices were improving and some of the older cows and the "no hopers" found themselves in the saleyard.

As this market continued to improve, more of the lower producers were culled and the cash was used to purchase registered pure bred stock with known production ability or stock from dams which had proved their worth.

This practice was followed until most of th original cows were disposed of, and the heifer bred from these cows had met a similar fate.

To-day the Henderson farm supports:

	35	Milking cows (30 of which are pure bred
	23	Heifers (All pure bred)
	14	Heifer Calves (All pure bred)
	4	Bulls (Pure breds—Three of working age)
Total	76	

It might be assumed that this change-ove would prove a costly business but the fact is tha Mr. Henderson had some "change over" afte the transaction. It must be borne in mind tha these herd changes occurred over a period of years, and at a time when "tinner" prices wer extremely favourable.

Costs and receipts were as follows:

	£
Cash receipts from sale of stock . .	2,083
Total purchases of pure bred stock . .	1,571
Profit from transactions	£512

The change-over to production-backed stock has also meant greater monthly returns by way of the cream cheque.

Mr. Henderson supplied the following figures showing a production increase of over 50 per cent. in the last 3 years:

Financial Year	Average Production of Commercial Butter per Cow
1957–58	211 lb.
1958–59	302·4 lb.
1959–60	326 lb.

Daily Production Record

Mr. Henderson keeps a daily record of the number of cows milked. At the end of the month he is able to divide the pounds of commercial butter produced by the average number of cows milked a day to ascertain the average daily production of his herd. His monthly calculation looks something like this:

Lb. of commercial butter as per monthly factory statement .. .. .. = 847
Days in the month .. .. .. = 30
Lb. of commercial butter a day .. = 28·23
Average No. of cows milked per day = 29·4
Lb. of commercial butter per cow per day .. .. = 0·96

There is another angle to this increased production which did not escape the notice of Mr. Henderson.

Even the worst producing cow has a profitable period of production. It may be only the first 30 days or may extend to 100 days, but that profitable period of production can be exploited before the cull heads for the sale yard.

In addition to culling and the purchase of stock with production backing, Mr. Henderson and his son have carried out recommended practices such as quiet handling of stock, rotational grazing, fodder conservation in the form of hay and ensilage, and adequate feeding, all of which play an important part in contented stock, better returns and contented farmers.

* * *

Weed Control In Linseed And Safflower

Linseed has a low tolerance to the chemical weeders at present available. *Never use 2,4-D to control weeds in linseed.* MCPA, a close relative of 2,4-D, is the safest formulation to use. "Tuloxone" and "Methoxone" are two proprietary lines available on the Downs. Both are 30 per cent. concentration, that is, 3 lb. of active ingredient to the gal.

MCPA at rates of up to 4 oz. (active ingredient) per acre can be used.

To minimise crop damage, relatively high volume is recommended. At least 20 gal., or preferably 30 or more gal. should be used.

This means that only the easy-to-kill broad-leafed weeds such as turnip weed can be safely controlled in linseed. Climbing buckwheat and wireweed cannot therefore be controlled in this crop. The use of wetters should not be used when spraying this crop.

The spray should be applied when the crop is 4 to 10 in. high. Avoid spraying seedlings and when the crop is approaching flowering.

Some crop damage is always likely especially if low volume is used. For this reason high volume is recommended.

Safflower, unfortunately, is very susceptible to both 2,4-D and MCPA, which cannot be used on this crop.

The new herbicide 2,4-DB was tried last year on safflower but serious crop damage at all rates resulted.

—*S. R. KLOSE, Adviser in Agriculture.*

stock and station

What's This "Cage Layer Fatigue"?—Recently we have been asked whether "cage layer fatigue" occurs in Queensland. Some poultry owners suspect it has occurred in their laying cages.

The term "cage layer fatigue" originated overseas a few years ago. The disorder affects birds in laying cages after having been reared on range. It is reported that "cage layer fatigue" affects only good laying strains, laying 85 to 90 per cent. and then only among the top layers producing at the rate of 100 per cent. Affected hens develop a partial or complete paralysis of the legs. However, when placed on the ground, they recover. It is thought that the exceptionally high rate of lay strips the hen of essential nutrients faster than she can absorb them from the feed thus leading to the condition.

"Cage layer fatigue" may therefore be regarded as a nutritional deficiency disorder. Placing affected hens on the ground naturally causes the egg production to drop and hence eases the drain on body nutrients. This leads to recovery.

"Cage Layer fatigue" should not be confused with neural leucosis which is a common cause of leg paralysis in fowls starting to lay. This disease is caused by a virus and is not "cured" by placing the affected birds on the ground. Only one in every 20 cases of neural leucosis seems to recover but these usually relapse again. In advanced cases the legs become very thin.

It is uncertain whether true "cage layer fatigue" occurs here except in exceptional cases. However, with the development of improved laying stock, the appearance of this disorder could be expected.

—*P. D. RANBY, Veterinary Officer.*

An Efficient Flood Fence.—During every wet season in Queensland, floods damage or destroy an enormous amount of costly fencing. To overcome this recurring problem, Mr. Bob Clapp, a grazier from Texas, Queensland, has invented a flood fence that really works.

His fence consists of a series of pre-strained sections, each up to a quarter of a mile in length. Each section is pivoted on an anchored wire at ground level so that the fence will yield under pressure of flood water.

Each section goes down as a complete unit and remains fully strained in all positions. It can therefore be raised again in a matter of minutes after a flood has passed.

Secret of this fence is the use of special steel straining frames at the ends of each section. Fences can be kept fully strained by simply tightening a nut on the base of each frame.

—*A. F. SKINNER, Senior Soil Conservationist.*

Check on Water Supplies.—Looking after water supplies is an important job on cattle properties. There is no substitute for regular attention to watering points. Stock can't live without water.

When the days are hot and the grass dry, cattle need increasing quantities of water. Evaporation rates also increase in the summer.

The small surface tank or waterhole which had water in it last week may be dry now. In many cases cattle won't voluntarily leave their usual water point so have to be shifted to other water before it's too late.

Steep banks and obstacles such as logs near water points are traps for weak stock, as are boggy water points. Bogging is common at certain times of the year but it usually results from stock seeking a green pick rather than water. Where awkward or boggy approaches are associated with water points it is sound business to equip the site with a mill to pump the water into troughs.

In the case of bores or wells it is necessary to check on water *quality,* as there is sometimes a sudden rise in undesirable solids. A quick simple test is to taste the water yourself. If it is very unpalatable, send a sample to the Agricultural Chemist for checking.

—*W. F. MAWSON,*
Senior Adviser in Cattle Husbandry.

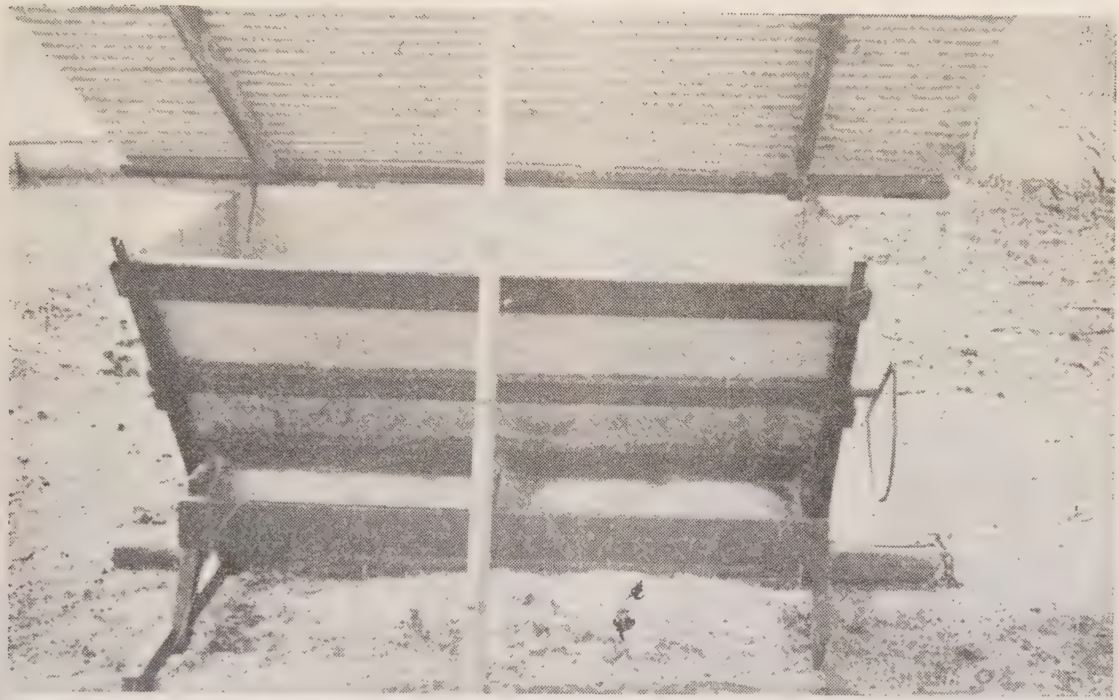

Plate 1

Sheep Self-Feeder, Showing Sheep-Activated Agitator on Right.

Sheep Self-Feeding Made Easy

By C. R. SMITH, Senior Adviser in Sheep and Wool.

Supplementary feeding of sheep is carried out n many Darling Downs sheep farms both in dry imes and to some extent in periods when there s lush feed available.

Dry-time feeding of supplements can assist heep to make better use of poor-value paddock eed. At times, also, good green oats is available n a crop paddock but cannot be used for grazing ecause inadequate rain has resulted in shallow ooting of the oats. Under such conditions, grazing sheep would ruin the crop by pulling out whole plants. Whilst waiting for the oats to root more securely, the feeding of a supplement to sheep running on native grasses can prevent lambs from receiving a setback.

When green crops are very lush, the provision of a supplement of drier roughage can aid the sheep's digestion, and forestall such troubles as bloat.

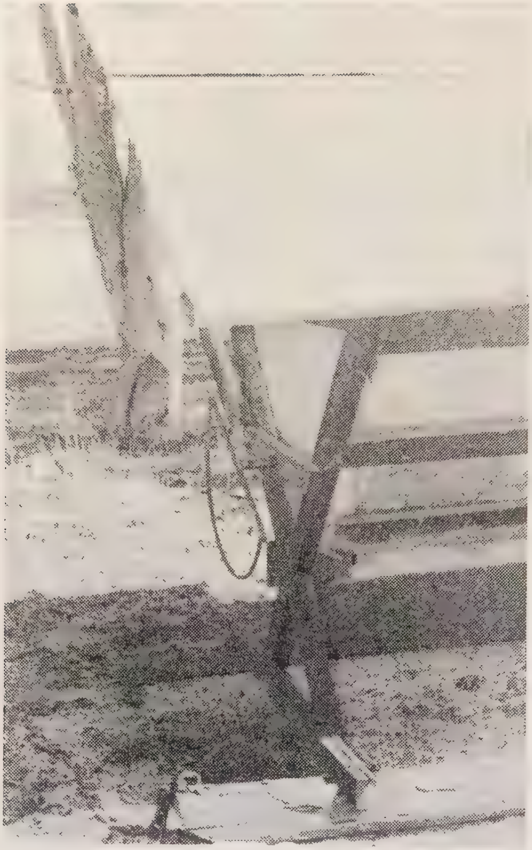

Plate 2

A Close View of the Semi-circular Agitator.

For these types of feeding, "self-feeders" are used extensively, and for reasons of economy, home-made feeders are frequently to be found on farms. A common drawback of all types of self-feeders is that the fodder in the bin does not always fall down into the trough as intended. Although the bin has been filled regularly with fodder estimated to last a long time, blockages occur and the trough runs short of feed. Sheep suffer in consequence.

One Darling Downs farmer confronted with these problems devised more than one method of putting things right. One means took the form of a simple device which was, in effect, a "sheep-actuated agitator" fitted to the side of the self-feeder.

The part moved by the sheep consisted of a semi-circular frame made from a light flat iron crossbar welded to a semi-circular steel rod (see Plates 1 and 2). This was welded on to a piece of three-quarter in. piping running like a shaft along the whole length of the feed bin. To this were welded five or six pieces of one-eighth of an inch flat iron, each 6 in. long and 2 in. wide. These vanes were welded to the three-quarter in. piping at varying angles along the length of the pipe. The lowest part of the outside semi-circular frame was at "rubbing level" for an average sheep's back.

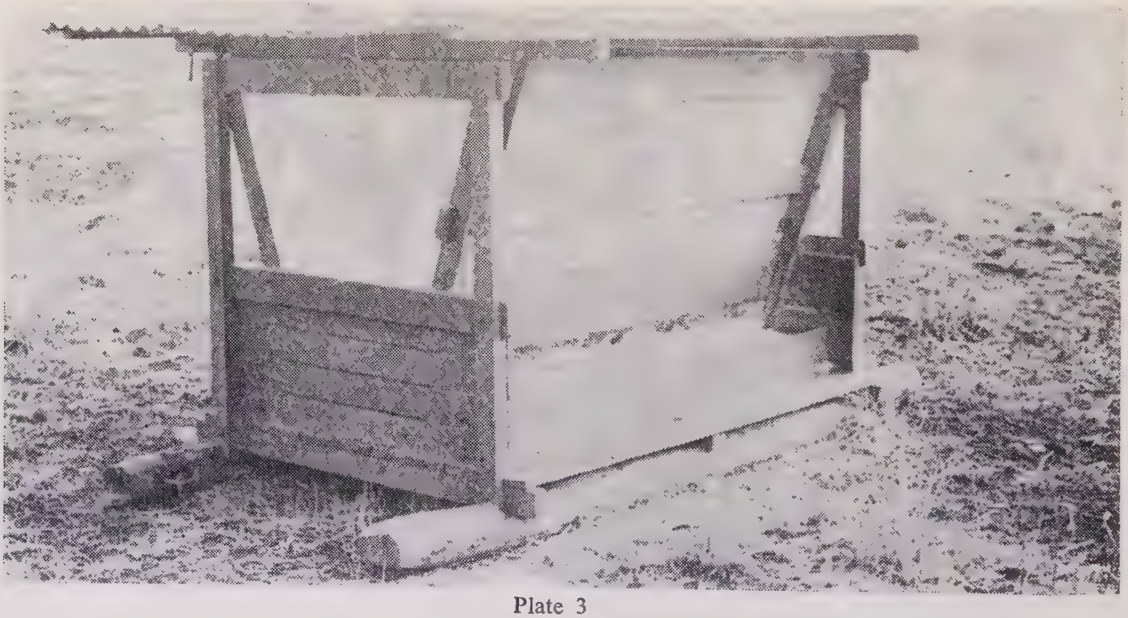

Plate 3

The Sides Are Farther Apart At the Bottom Than Usual.

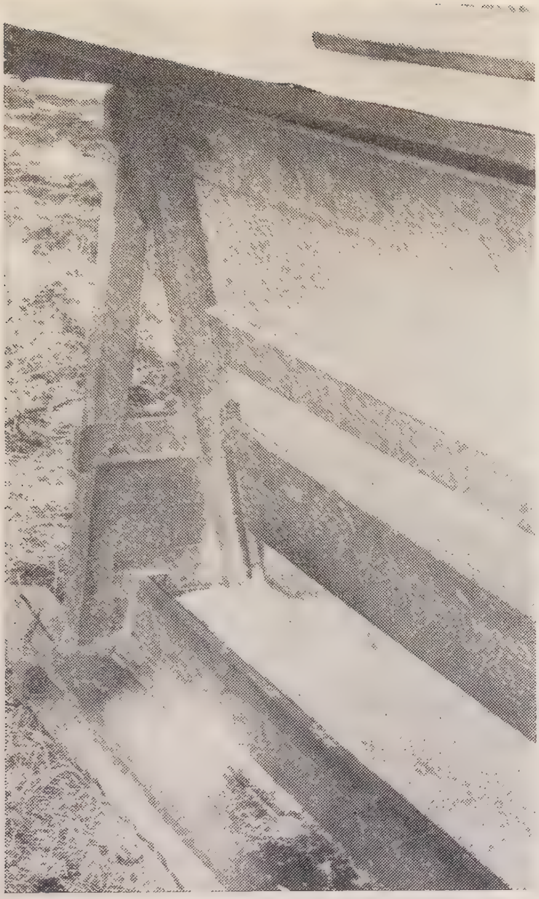

Plate 4

The Bottom Slat Can Be Raised or Lowered to Suit the Density of the Fodder.

Observation and knowledge of animals' habits can sometimes, with ingenuity, be turned to valuable practical use. Sheep, in common with most animals, like to rub their backs occasionally on some convenient object or projection. This characteristic was made good use of by the alert farmer. Sheep jostling and wandering around the self-feeder found the semi-circular frame a convenient rubbing point. This, in turn, moved the longitudinal pipe and its attached iron vanes, agitating the fodder and so allowing it to run into the trough.

Alternative Method

Experimenting to solve the problem of feed blockage, the same farmer approached the problem from another angle, but with equally useful results. He had observed that a good deal of the blockage was due to the narrowness of the peak of the V formed by the approaching sides of the fodder bin. He therefore constructed a feeder so that, at the bottom of the bin, the sides were farther apart than is usual. (See Plate 3.)

He then improved the feeder in a manner that allowed him to modify the rate of flow of the fodder. This was done by constructing the bottom slat of each side of the bin so that it would be moved upwards or downwards. This was provided for by allowing for each end of the slats to move in angle iron grooves fixed to the sloping uprights. (See Plate 4.)

In the final arrangement, the bottom slat on each side could be raised or lowered and then fixed at a desired point to suit the density of the particular fodder in use. With coarse fodder, the slats would be adjusted to a high level, and with fine fodder kept fairly low.

* * *

Common Weeds of Farm and Pasture

by S. L. Everist, B.Sc., Government Botanist.

A handbook that contains brief descriptions of about 110 of the common weeds of Queensland with notes on their distribution and control.

Price to Queensland farmers	5s.
To others	7s. 6d.

Available from Department of Agriculture and Stock, Brisbane.

Plate 1

These 3 Year Old Steers on Oats Gained 2.6 lb. a Day. They were sold at Cannon Hill in September, 1959, when prices are higher than average. The steers were grown on natural grass and bought by a fattener in the Miles district.

The Cost Of Crop For Fattening Cattle

By K. F. HOWARD,* Senior Adviser in Cattle Husbandry.

The actual costs of producing a crop for cattle fattening in the Miles district are given in this article.

The main factors causing variations in costs are:

(*a*) The amount of money invested in machinery in relation to the area cultivated.

(*b*) The number of workings a paddock receives.

(*c*) The cost of seed.

Naturally, second-hand machinery would mean less outlay but other factors come into play. The main ones are:

(*a*) Extra cost for repairs.

(*b*) Additional inconvenience from breakdowns.

---

* Mr. Howard has resigned since this article was prepared.

A plant which is on the large side means that obs can be done quicker. This can be a big actor when advantage has to be taken of moisture or working or sowing. It generally pays to work he plant "around the clock" when such is the ase. Some graziers prefer to employ additional abour for tractor driving during peak periods.

It is possible to work 600 acres of country with plant costing £3,000 as new. This means an utlay of £5 an acre. The explanation for some ultivation being more expensive is that from £10 o £20 an acre is sometimes invested in machinery.

The following actual cost particulars for crop ave been tabulated by Mr. W. D. S. Harpham, t his Yandarlo property, Miles:

a) **Brigalow–Belah:**

Taken from the stage where it has been dead or 5 years after ringbarking. Pulling, 15s.; stackng and burning, 30s.; first ploughing and collectng roots, 25s.; total, £3 10s. an acre.

b) **Box and Sandalwood:**

Pulling, £1; stick-raking, 37s. 6d.; burning, 2s. 6d.; first ploughing, 25s.; total, £5 5s.

Fencing: On the basis of small paddocks, that s, 1 mile per 100 acres, is 30s. an acre when encing costs are £150 a mile.

Water: Based on 3,000 yards per 500 acres. ank, £375; turkey's nest, £50; mill, £125; fence rough, £100; making £650, or 26s. an acre.

The total capital cost for preparing brigalow ountry for cultivation is therefore £6 6s. an cre, including the first ploughing. Interest per ear on this outlay is 7s. 7d. an acre.

Machinery costs in 1958 were: Tractor, £1,720; hisel plough, £345; disc harrows, £255; combine, 460; making a total of £2,780.

The following is the actual cost for working 17 acres for the first year of operation:

	£	*s.*	*d.*
Diesel fuel 516 gal. at 2s. 8d. a gal. ..	68	8	0
15 gal. oil at 16s. a gal.	12	0	0
½ drum grease	2	0	0
488 operating hours at 8s. an hour ..	195	0	0
Seed purchased	286	0	0
Depreciation at 15 per cent.	420	0	0
Interest on machinery at 6 per cent. ..	175	0	0
	£1,158	0	0

No repairs were incurred during the first year.

This gives an average cost per acre of cultivation of £2 15s. 6d.

With the addition of 7s. 7d. for interest on fixed improvements, the inclusive cost for an acre of cultivation is £3 3s. 1d. This cost is slightly higher than normal years as seed oats was particularly expensive.

Plate 2

Calves Weaned at 10 Months of Age. The steers weighed 739 lb. and had gained at the rate of over 2 lb. a day. They were weaned on to a crop of sweet sorghum and marketed the following spring after final fattening on winter crop.

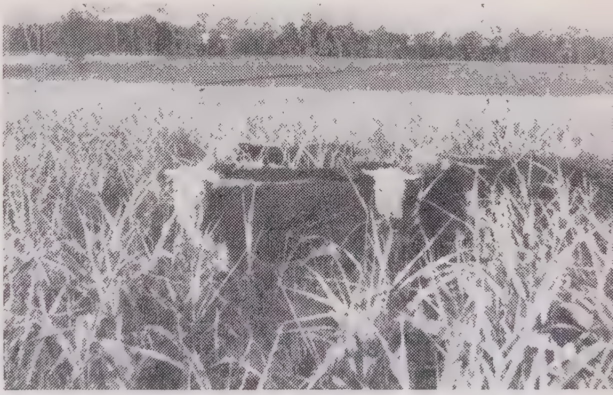

Plate 3

Steers Fattening on a Late Crop of Sweet Sorghum in the Wandoan Area in May, 1957. The sweet sorghum permitted fattening when lack of rain prevented grazing of winter crops before July.

Examples of working costs of 4 paddocks:

	Cost		
	£	*s.*	*d.*
1. 80 acres with three workings, sown to sweet sorghum with seed costing 2s. a lb. Sown at 5 lb. an acre	2	16	0
2. 70 acres, five workings, sown to canary, oats and rape . .	3	7	0
3. 90 acres, four workings, sown to wheat	3	7	0
4. 40 acres of new country, four workings, sown to oats and vetches	4	0	6

The high cost of No. 4 paddock was principally caused through dear seed. In this case the seed cost 30s. an acre as against 10s. an acre in No. 1 paddock. The year (1958) was very dry, which meant that the ground could not be worked unti late. In normal years seed costs would be lower but another 5s. to 10s. an acre could be spent on weed control.

It can therefore be seen that a cost of £3 10s an acre of cultivation is a conservative figure when machinery is worked to its capacity.

In this account no allowance has been made for the production which would have been obtained from the land if cropping had not been undertaken.

* * *

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Irrigated Pasture Gives High Yield At Cooroy

By J. H. SMITH, Dairy Officer.

A 7-acre area of irrigated pasture planted in pril, 1959, on Mr. Tom Quinn's farm at Cooroy, ielded 36·8 tons of green pasture per acre to the nonth of June, 1960. This yield of green naterial is more than spectacular when one coniders that the unimproved mat grass/paspalum astures in the Cooroy area yield only 5 tons of reen material each year.

This pasture area was established on Mr. uinn's farm under the Commonwealth Dairy xtension Grant. In 1958, Mr. Quinn contructed a 6 million gal. dam with financial aid xtended under the Farm Water Supply Act. The am was constructed to supplement the water upply for pasture irrigation from a small stream hat runs through the property.

The purpose of the water conservation and rrigated pastures set up on Mr. Quinn's farm as to demonstrate to district farmers the part onserved water and improved pastures can play n providing a continuity of good quality feed all ne year round and so increasing butter producon.

The first undertaking in the demonstration was o pre-crop the intended pasture area with Poona ow-pea and white panicum. The idea of preropping was to work out most of the mat grass nd also improve the soil condition. A mixture f 25 lb. of cow-pea and 12 lb. of white panicum was sown per acre in October, 1958. The seed-bed prepared by Mr. Quinn was good. This, with the application of 2 bags of Shirleys No. 9 fertilizer per acre, was responsible for the paddock presenting 12 tons of green material per acre at the first grazing. In all, this paddock yielded 650 cow/hours of grazing per acre.

In April, 1959, the area was sown to pastures. The good seed-bed prepared by Mr. Quinn was fertilized with 10 cwt. of lime and 3 cwt. of superphosphate per acre. In addition, 1 bag of sulphate of ammonia was applied to 1 acre and some potash was applied to determine the likely response from these two major elements.

Drought the Test

Drought conditions provide the real test for fodder reserves and feeding practices. Mr. Quinn, with the additional quantities of feed produced under his improvement programme, found it necessary to purchase only mineral supplements during the dry hard conditions of the winter of 1960. This was in contrast to the drought conditions of 1957 when he had to seek a drought relief loan from a local bank to purchase considerable quantities of concentrate.

The pasture mixture consisted of 6 lb. of H1 rye-grass, 2 lb. of Ladino white clover, 1½ lb. of New Zealand white clover, 2 lb. of New Zealand cow grass red clover, 1½ lb. Louisana white clover and 4 lb. of perennial prairie grass per acre.

Twelve weeks after planting, the pasture was ready for grazing. Since then, details of grazing obtained and the yield of green pasture in tons per acre have been recorded. To June 30, 1960, records show that the pasture yielded 2,341 cow-hours of grazing per acre and 36·8 tons of green pasture per acre.

Upon looking into the grazing records, it was found that the heavier the pasture yield per acre, the more green pasture the cows consumed per hour. For example, when the pasture presented 6 tons of green material per acre at grazing time, the cows consumed approximately 30 lb. of green material per cow per hour. When the pasture presented only 4 tons of green material per acre at grazing time, the consumption rate per cow fell below 25 lb. per cow per hour.

A pasture sample from the demonstration area was submitted for analysis. The composition was as follows:—Protein 23 per cent.; carbohydrate 42 per cent.; fibre 22·5 per cent.; lime 1·74 per cent.; phosphoric acid 0·55 per cent.

For comparison, a sample of adjoining mat grass pasture was analysed. Its composition was as follows: Protein 6·4 per cent.; carbohydrate 56 per cent.; fibre 30 per cent.; lime 0·22 per cent.; phosphoric acid 0·29 per cent.

Comparing the performances of the two pastures, the irrigated pasture yielded 7 times more bulk than the mat grass pasture. It contained nearly four times more protein.

Because of the high yield obtained from the pasture, it was decided to top-dress the pasture in January of this year with two bags of Shirleys No. 9 per acre. A second top-dressing was done in early August with two bags of Q5 mixture, which is a complete fertilizer.

Of the pasture species planted, the perennial prairie did not contribute much to the yield of the pasture. The Ladino clover proved to be more vigorous than the Louisiana white clover; though the Louisiana proved to be a prolific

Plate 1

Six Million Gal. Dam Constructed at a Cost of £720 and Financed by the Farm Water Supply Act.

Plate 2

Poona Cow-pea and White Panicum Which Yielded 12 Tons of Green Material to the Acre at the First Grazing.

Plate 3

This Pasture Produced 36.8 Tons of Green Pasture to the Acre over a 15-month Period.

seeder, with a number of young seedlings coming away at time of writing. The 1 bag of sulphate of ammonia applied to 1 acre at planting time did have a vast effect on the rye-grass. It was much more vigorous in that area than anywhere else in the pasture. To date, no response has been obtained from the potash applied.

The total amount to date in £ s. d. outlaid on this pasture for seed, fertilizer, fuel for land preparation and fuel for irrigation, amounts to only £131. Considering that the pasture has yielded approximately 250 tons of green material, the cost of providing this pasture has been very economical.

Because of the good rainfall distribution over the spring and summer period, irrigation of the pasture was limited, only 5 inches being applied.

To suppress weed growth, it was necessary to mow the pasture five times during the 15-month period.

Mr. Quinn's butter production showed an increase of 35 per cent. over the previous year's production.

Annual Butter Production, 1956–57 to 1959–60

1956–57—6,656 lb. of commercial butter
1957–58—4,388 lb. of commercial butter (drought year)
1958–59—6,458 lb. of commercial butter
1959–60—8,700 lb. of commercial butter

The butter production for 1959–60 was not remarkable, but it was a big improvement over past years' production. The commercial butter production per cow for 1959–60 was approximately 180 lb. for the herd.

Mr. Quinn states that with 15 to 20 acres of good irrigated pasture, he not only expects to increase the production per cow but also increase the herd number from 45 to about 60 on his 170-acre farm.

This year Mr. Quinn has planted a further area of 8 acres of pasture and he expects that the butter production for 1960-61 will go beyond 10,000 lb. of commercial butter. If so, Mr. Quinn will soon recoup the outlay of his water conservation project and build his farming enterprise into a sound business.

Improved Pastures For The Central Burnett

By N. F. FOX, Agrostologist.

More information is coming to hand about the nutritional status of the beef cattle pastures in south-eastern Queensland. It is well known that during the winter and spring months of almost every year, cattle lose weight and that if the usual regrowth is delayed until the summer months, stock, particularly breeders, die from malnutrition. The bulk of grass is usually adequate but its quality is so low that stock are unable to use it.

It has been suggested that the quality of the beef animal's diet may be improved by one, or a combination, of the following methods:

1. The growing of annual crops like oats or sorghum to be grazed, or harvested and fed back to the animal as required.
2. The establishment of small areas of irrigated pasture to be used in conjunction with native pasture which will supply roughage.
3. The introduction of an effective legume into native pastures.
4. The establishment of a perennial legume crop (lucerne) which can be grazed in association with native pasture.
5. The establishment of sown pasture mixtures.

The first two propositions, the growing of annual crops and the use of irrigated pastures will not be discussed here. While their application is sound under certain circumstances, other methods may be of greater interest in the Central Burnett district.

The introduction of a legume into our native pastures would be the most logical and probably the most economic approach. This has been possible in southern Australia where with the aid of superphosphate it has been possible to establish subterranean clover. Soil fertility has been improved and more productive grasses have established.

However, to date we have not been able to find an efficient legume which will persist and compete with the vigorous summer growing grasses under the climatic conditions in this part of the State. Townsville lucerne will grow with spear grass in the coastal area.

The establishment of a perennial leguminous crop to be used in conjunction with native pastures is a method of improving nutrition which has appealed to some cattle men. Lucerne is the only suitable crop at present available commercially. In the 20 to 30 in. rainfall belt, it may be grown in a sward at a low seeding rate (1 to 5 lb. to the acre). It is also regarded as a sound proposition to grow the crop in rows 42 in. or 63 in. apart and to cultivate between the rows. In this way, it has been possible to maintain growth under relatively dry conditions.

An area of 1 acre of lucerne to 8 to 10 acres of grass land is a satisfactory proportion for bullocks, or ½ to 1 acre for each grazing animal.

One grazier in the Wandoan district during 1951 used his lucerne as a "hospital paddock." He went through his paddocks and cut out cows low in condition and moved them on to the lucerne areas.

It is convenient to have an area of lucerne in each paddock, although this is not always possible. Rotational grazing of lucerne is essential in order to maintain a continuity of growth and to reduce the damage to the stand which occurs with continuous grazing. For this purpose, the layout in Plate 1 is effective.

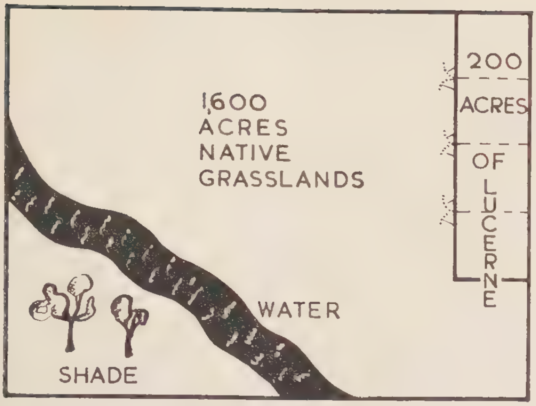


Plate 1

A Satisfactory Paddock Arrangement.

Seedbed preparation must be good. Virgin land should be cropped for 1 year and preferably 2 years before planting. Fallow before sowing to lucerne in order to build up a supply of soil moisture. If row lucerne is to be grown, sow at the rate of 1 to 1½ lb. of lucerne to the acre. On the Darling Downs, farmers sow this crop for grazing in spacings from 7 in. up to every seventh run of the drill (3 ft. 6 in.) These row spacings would be satisfactory in the Burnett districts. If considering the establishment of row lucerne, consider carefully the likely losses from soil erosion and take appropriate measures to counter this.

Remember that all legume seeds like lucerne should be inoculated with an effective strain of nitrogen-fixing bacteria. This inoculum can be obtained on application to the Department of Agriculture and Stock, Brisbane.

Three to four cultivations a year may be required to control weed growth. Most common cultivation implements can be adapted for this purpose.

The establishment of sown pasture mixtures in areas where it is possible to use implements seems to be the most satisfactory approach to the problem of improving animal nutrition.

Before contemplating the establishment of sown pasture mixtures, however, there are two considerations which must be given some thought.

Firstly, is the land which is topographically suitable sufficiently fertile to sustain sown pastures, and if not can it be economically made so? It must be realised that plant species which are highly productive and nutritious will grow and persist only under conditions of reasonably high soil fertility. The soil must contain adequate supplies of mineral nutrients and should not suffer from physical defects of structure or texture. Soils which waterlog and dry out alternately are difficult to manage, and very heavy clay soils are difficult to handle. Many of the sandy soils are deficient in calcium and phosphate and often trace elements. If deep they are often "droughty." In general, the scrub soils, the dark grey-brown or black soils formed from basalt, and some river alluviums are suitable.

Secondly, what grass and legume species can be grown, and is seed procurable?

Rhodes grass, green panic, buffel grass can be grown and seed is available in commercial quantities. However, the selection of legumes is very restricted. **The legume is all important.** Without it, it is unlikely that sown pastures will persist on forest soils. The legume supplies that extra nitrogen that these grasses require as well as the protein stock need to maintain growth rates. **One pound of lucerne seed to the acre** in a Rhodes grass pasture at Lawes has added to steers grazing that pasture 100 lb. live weight gain over steers grazing Rhodes grass alone.

Lucerne and phasey bean are two legumes which can be used. Phasey bean seed is in short supply and difficult to obtain. Lucerne is not a good pasture legume in that under continuous grazing it may soon be eaten out. If the pasture containing lucerne can be rotationally grazed say 2 weeks on and 6 or 8 weeks off over 4 to 5 paddocks, it will persist indefinitely. The rotation allows lucerne to make top growth, to seed at certain times and to replenish its root reserves.

Rhodes grass, green panic, and buffel grass are vigorous growers and each can be combined with lucerne and phasey bean in a pasture mixture.

Seeding rates depend on quality of the seed and seedbed preparation but in general 3 lb. of grass, 1lb. of lucerne, and ¼ lb. of phasey bean to the acre can be used.

Seedbed preparation should be thorough. Seed to-day is costly and as weather conditions following sowing are often unpredictable it generally pays to sow early on to a well-prepared seedbed. Prepare land during the winter and spring months and sow following the first good rain in the New Year. This usually ensures that the planting has been accomplished before the wet season in February–March and that young seedlings have excellent growth conditions during their most vulnerable stage.

The success of the venture after establishment depends on management. In the Burnett, a Rhodes grass, lucerne stand should average one 2-year-old steer to 4 acres and in good years may stand heavier grazing.

Costs and Returns

From the grazier's point of view the economics of sown pastures is probably the most important feature.

Costs will vary greatly. They depend on the manager and his ability, where he lives, his country, the equipment he uses and, of course, on the season during which the project is undertaken.

The following costs are suggested as a guide only, and would apply to Gayndah:

Using a medium h.p. tractor with a life of 10 years or 8,000 hours, it can be shown that this unit costs about 18s. 2d. an hour to operate including tractor driver's wages. A chisel plough and seed box will cost about 2s. an hour. The cost of operating a tractor and chisel plough would be about £1 0s. 2d. an hour. On this basis, it would cost about 8s. 1d. an acre to work the land. On the basis of four workings to include planting, the cost of land preparation (excluding clearing) would be approximately 32s. 4d. an acre.

Cost of Rhodes and lucerne seed, 30s. an acre.

Total cost of land preparation and seed = £3 2s. 4d. an acre.

Fencing and water varies with the size of the area.

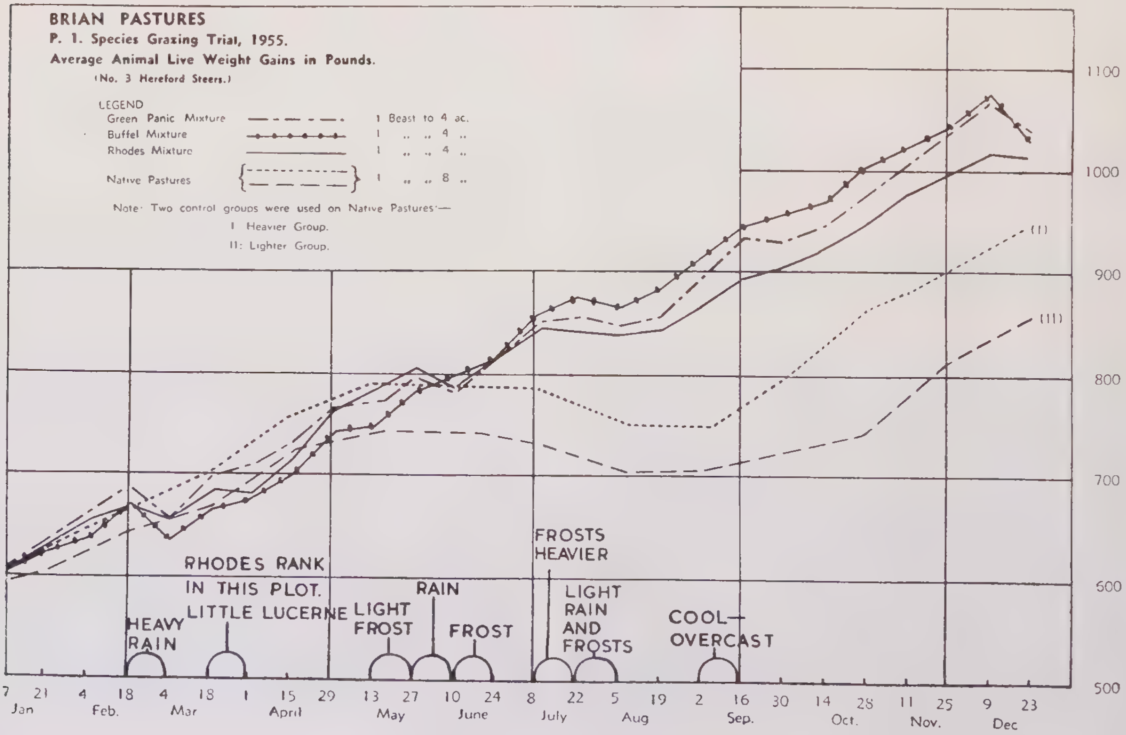
To fence and subdivide 300 acres into 4 paddocks @ £200 a mile is £2 16s. an acre.

To fence and subdivide 640 acres into 4 paddocks @ £200 a mile is £1 18s.

Thus the cost to fence and establish 300 acres of sown pasture could be as high as £5 18s. 4d. an acre.

The results obtained from several grazing trials which have been conducted in varying parts of the State indicate that at this figure the expenditure is worthwhile.

The graph shows the weight gains of three groups of animals on sown pastures and that of a similar group on a good native pasture, in a trial carried out by the Department of



Agriculture and Stock on the Australian Meat Board's Beef Cattle Pasture Research Station at Gayndah.

The live weight gains on sown pastures for the year averaged 120 lb. an acre, while the same class of animals on native pasture gained 36 lb. an acre. The production increment per acre following the establishment of sown pastures would be about 75 lb. dressed weight increment in the type of animal grazed.

At £10 per 100, the increment per acre is £7 10s. The position is somewhat better than indicated. It is doubtful if the group on native pasture would be finished before March, 1957.

At a heavier stocking rate, and under controlled conditions in southern Queensland, Rhodes grass, lucerne pastures produced as much as 255 lb. of live weight gain per acre in 1950 and 199 lb. per acre in 1951.

It may prove that the sown pastures under discussion could be used more efficiently. It is possible that by management a greater number of animals could have been grazed during the period April 29 to September 30—the 5 lean months.

However, sufficient evidence exists to indicate that sown pastures are going to play an increasingly important part in the economy of the beef industry in this State. If trends in southern Australia are followed in Queensland, we can look forward to a period of rapid increase in the areas sown to pasture.

* * *

Weeds Rob Your Crops And Increase Costs

Weeds are a major economic factor in reducing yields. They compete very strongly with crops for the available moisture and valuable nitrate nitrogen you store in your fallows.

So it is vital to control these weeds before they rob your crop.

Good farming is the first line of attack on weeds. Chemical weeding is a second line of attack and must be considered as an aid to a good farmer. Climbing buckwheat has been particularly troublesome.

The recommended control of difficult and resistant weeds in winter cereal crops is the check-smother method with 2,4-D.

The cereal crop, which has a high resistance to 2,4-D, is used to compete for the available soil moisture, plant nutrients and light to suppress the weed you wish to control.

When these weeds are given an early check the more resistant crop will grow rapidly, making full use of the moisture and nutrients you have stored in your fallow.

Further, there is reason to believe that the weeds produce less viable seed or, in some cases, none at all.

Climbing buckwheat, wireweed, variegated thistle and hexham scent can be successfully controlled by the check-smother method with 2,4-D plus additional wetter.

The recommended rate of 2,4-D is ½ lb. of 2,4-D acid to the acre. Using 50 per cent. concentrate 2,4-D, this means 1 gal. to 10 acres of crop.

Oil company detergents are satisfactory wetting agents. Use 1 pint to 200-250 gal. of spray solution.

For best results, the weeds must be actively growing and in the seedling stage. Crops growing on fertile, well-prepared soil provide the best conditions for controlling these weeds.

—S. R. KLOSE, Adviser in Agriculture.

Plate 1: **Highly Productive Glycine-Grass Pastures at the Kairi Regional Experiment Station Have Brought New Life to Old Farm Land and Stimulated the Interest of Farmers.**

Glycine Proves Its Value

By G. H. ALLEN, Senior Agronomist.

High production of pastures depends very largely on the supply of nitrogen. The legume, glycine, has proved to be a most valuable pasture component. It has a high nutritive value for livestock and contributes nitrogen to the soil, thereby promoting improved growth of grass.

Since the general distribution of information on glycine in this Journal in issues for May, July, August and November, 1960, further developments have produced better seed production and testing over a wide area of the State.

The early promise shown in Departmental trials has been fully substantiated and it seems obvious that this legume will add greatly to the development of pastures and the livestock industries in northern and coastal areas.

Approximately 3,500 lb. of glycine seed from harvestings at Regional Experiment Stations have been allocated to certain districts and several hundred farmers have obtained small quantities for new plantings. Some farmers with harvesting equipment have obtained material for establishment of sizeable seed production areas.

Recent observations in northern and central Queensland indicate that glycine is suited to many districts. Some problems of establishment have appeared in areas with acid granite soils. In the Kairi section of the Atherton Tableland, pastures of glycine with Rhodes or green panic grasses continue to improve in production and carrying capacity. Stands up to 7 years old are still improving.

1
2
CENTIMETRES

Plate 2

The Nitrogen-Producing Nodules Develop Strongly on Glycine Roots.

Despite dry weather, active regrowth occurred from stems heavily frosted in winter. In heavy grass stands which protected the legume from frost, active growth was evident during September and rapid high production can be expected after spring or early summer rains.

In the Burdekin region glycine was frosted and leaf shedding occurred when temperatures fell to 35 deg. F., whereas centro was adversely affected by winter temperatures of 40 deg.

Glycine responds quicker than centro to rising temperatures and combines more favourably in pasture mixtures.

During the summer wet season, centro will produce more rapidly than glycine but due to the longer season of growth and persistence of glycine it seems likely that this legume will eventually prove most suitable for pastures in the "dry tropics".

Glycine is more palatable than centro and normally it has a higher protein content. It passes on nitrogen to associated grasses in all areas where studied at present and the root rhizobia are active and easily transmitted.

Glycine is very slow in the first season but during the second summer, heavy production can be expected. Careful management is therefore necessary in the establishment period.

Plantings of glycine in the Callide Valley were heavily frosted during winter but new growth was present during September and October and the development of this legume in grass pastures in central districts will be watched with interest.

On the north coast dairying lands of New South Wales, glycine has established well and expansion of plantings can be expected.

The strain now being distributed was introduced from Kenya by the Department in 1947. More than 20 other strains of glycine obtained from different parts of the world are now being studied at a number of Queensland centres and no doubt some of these will prove useful for certain areas.

Further development of this group of legumes will give a marked improvement to the agricultural and livestock industries by supplying nitrogen to the soil while also giving highly nutritious grazing. In studies in East Africa, a 9-year stand of glycine was found to contribute up to 160 lb. of nitrogen to the soil annually for the first 5 years and 100 lb. of nitrogen annually for the following 4 years.

These contributions are equivalent to applications of 7 cwt. and 4½ cwt. respectively of sulphate of ammonia each year.

Pasture production has been trebled with nitrogenous fertilizer applications at these higher rates and even if a legume component supplied 50 lb. of nitrogen annually the great limitation to pasture production would be cheaply overcome.

◆

Don't underestimate the fowl tick

By P. D. RANBY, Veterinary Officer

The importance of fowl ticks should not be underestimated. The adult ticks not only worry the birds at night but transmit an organism called a spirochaete. This causes a severe sickness in the birds called spirochaetosis or fowl tick fever. Fowls affected by this disease become rapidly depressed, develop a green diarrhoea, lose weight and die in a few days. Many also develop a paralysis of the legs. The organism is present in large numbers in the blood and may be identified by means of blood smears.

The fowl tick, *Argus persicus,* is a pest of poultry, including fowl, turkeys, ducks and geese. It is very common in the drier inland areas on farms (grain and livestock) that keep small poultry flocks as a sideline. It is seldom seen on the coast, but once established there, can persist from year to year. Its distribution, therefore, is probably influenced more by management than climate.

Where to Look for Ticks

Adult fowl ticks hide away during the day in cracks and crevices of timber and in the bark of any nearby trees. They emerge at night to feed on the birds, being blood-sucking in habit. Adult ticks are oval in shape, dark to light brown in colour (depending on the last meal) and about one-third of an inch in length (see Plate 1). As with other ticks, the fowl tick possesses four pairs of legs. When exposed in their hiding places one may also find tick eggs and nymphs which are smaller and more slender than the adults.

When searching for fowl ticks, be on the look-out for the presence of tick faeces on boards, especially near the opening of cracks and joints of timber. Tick faeces are indicated by numerous greyish flecks adhering to the wood and are a useful sign of the presence of hidden ticks. If cracks and crevices are not easily exposed, probe them with a piece of tie wire about 6 in. or so long. The end of the wire should be slightly bent or hooked. If ticks are present, one will find tick blood or portions of broken ticks on the end of the wire.

The larval or seed ticks are found attached firmly to the skin under the wings and on the sides of the breast. These forms are almost spherical, one-eighth inch across, slaty blue in colour and possess three pairs of legs. Larval ticks remain attached for up to 10 days and then fall off. The larvae now develop on the ground to the nymphs. These feed and continue finally to the adult stage. Both nymphs and adults feed at night.

Fowl ticks are more active during the warmer months and may show little activity during very cold weather.

Combating the Parasite

Remember, eradication of fowl tick is made more difficult by its habit of seeking hiding places and also its ability to survive for two years or even longer without feeding on birds.

So spray the fowl-house out twice at two-week intervals and then monthly with a suitable insecticide such as malathion, dieldrin or aldrin. And use a strong jet in order to penetrate cracks and joints of timber. Avoid tar-oils, sump oil, and so on, as these cannot penetrate effectively and may even hinder other sprays from doing so. Spray the perches also, paying special attention

Plate 1

Five Fowl Ticks, Argus persicus, Are Seen Exposed in Their Hiding Place on a Piece of Board. A number of spherical tick eggs are also seen. This board is from an infested fowl-house and has been broken open to show the ticks inside a crack in the wood. This habit of seeking hiding places as well as the ability of fowl ticks to survive for long periods without feeding makes their control more difficult.

to the joints where they are fixed. Take care that food and water are not contaminated by the insecticide.

A blow-torch has been used by some people as a means of killing the ticks. This method is laborious and not likely to give a complete "kill."

Combine spraying of the fowl-houses with ridding the birds of larval ticks. In addition, remove any nearby rubbish or objects likely to harbour ticks.

The small larval ticks attached to the skin of the birds may be eliminated in two ways:

(*a*) If the flock is small, remove all birds to new temporary wooden quarters or crates well away from the permanent pens for 10 days. During this time the larval ticks will have left the birds. Now place the birds back in their permanent pens. The temporary quarters or crates must then be destroyed or sprayed with an insecticide to kill the ticks that have left the fowls.

(*b*) Dust each bird with 5 per cent. DDT or other material supplied for controlling fleas. Alternatively, the fowls may be dipped in 1 per cent. malathion or 1 per cent. DDT. Chickens under 8 weeks should not be dipped. Note: Although DDT is effective in killing larval or other immature ticks, it is not so effective against adult ticks.

Using New Pens

On livestock or other farms where small flocks are kept, the fowls often range and camp at night in the barn, in poorly built quarters or even in trees. Under these conditions it is virtually impossible to eradicate fowl ticks unless new fowl pens are supplied. Larval ticks should be removed from the birds as described before placing them in their new quarters. The walls of the new fowl-houses should be built preferably of fibro cement or similar material that will not harbour ticks.

Where fowl-houses are built of old, badly cracked timber, it may be impossible to eradicate fowl ticks. The old quarters should then be destroyed and the birds shifted to new quarters as described.

Using Suspended Roosts

Roosts suspended from the ceiling by wire may be used as a method of preventing ticks reaching the fowls at night. The perches should be arranged so that fowls sitting on them do not touch the walls of the shed. Suspended roosts are practicable where the fowl-house is built of badly cracked or old timbers that make eradication impossible.

Treating Fowl Tick Fever

If fowl tick fever accompanies the ticks, sick birds may be treated effectively by penicillin injected into the breast muscle. Use a dosage of about 10,000 units of procaine penicillin or 15,000 units of a triple penicillin (short, intermediate and long acting) made up in 1 ml. clean water. One injection is usually sufficient if given reasonably early.

Vaccines against fowl tick fever have been used in southern States in the past but are now seldom seen. The vaccine produces a temporary immunity sufficient to protect young birds.

Although treatment of fowl tick fever will save sick birds, controlling or eradicating the fowl tick is more effective in the long run.

Tobacco Pests In Queensland

By W. A. SMITH, Research Entomologist,

and G. W. SAUNDERS, Entomologist.

Queensland tobacco growers have to contend with a range of pests which attack the roots, stems and leaves of the growing plants, and the cured leaf in the farm bulk shed. Some of these pests are present on most farms every year, and even on new farms it is almost impossible to grow a payable crop without the use of suitable control measures.

The pests discussed here are mostly those of the northern and coastal areas of Queensland, but most of them also may occur on tobacco in other parts of the State. Major pests in the field are discussed individually in detail, but control in seedbeds is dealt with separately in the relevant section.

MAJOR PESTS

Tobacco Looper

Two species of loopers have been recorded as pests of tobacco; the tobacco looper,* a native species, is, however, of major importance. The common name is derived from the way the bodies of the larvae or caterpillars are arched or looped in moving. Leaves are eaten by all stages of the larvae and when large populations are present only the stems and larger leaf ribs remain. Usually the plants are left in a ragged condition, particularly the bottom and middle leaves.

Other hosts of the tobacco looper are potatoes, tomatoes and cabbages.

Life History and Habits

The pearly white eggs are slightly flattened and round in outline with a diameter of about one-fortieth of an inch. They are laid singly. It is common to find two or three eggs on the underside of the larger leaves, but eggs may be found on any part of the plant in smaller or larger numbers.

After an incubation period of 5 days the larva emerges from the egg and commences feeding on the tobacco leaf. It is thin, watery-white, and about one-eighth of an inch long with a black head and prominent black body hairs. After some leaf has been eaten the body becomes tinged with green. In this stage the grub eats the leaf from the lower side in holes one-eighth of an inch or less in diameter, and the transparent upper epidermis is left intact. After 4 or 5 days the larva casts its skin and enlarges slightly. The head of this (and of later stages also) is pale or light green and the body hairs are less noticeable. Two or 3 days later the looper again casts its skin and enters the third stage, when it attains the typical looper shape and colour. There may be as many as seven larval stages and the average time taken from hatching of the egg until the larva is full-grown is 27 days.

The full-grown looper caterpillar is about one-and-a-quarter inches long when at rest, but is capable of extending its body during movement. The forepart of the body is narrow and the rear segments are broader. The general leaf-green colour is broken by two white stripes along the back and by other variable white markings. Occasional specimens have prominent black spots on each body segment at the bases of body hairs. Because they do not eat, unhealthy or poisoned loopers fade to a light yellow. The looper differs from all other tobacco-leaf-eating grubs in having two instead of four pairs of "false" legs towards the rear of the body.

The fully-fed larva selects a sheltered site on the plant or beneath debris on the surface of the soil. There it forms a webbed covering and remains inactive for 2 days before changing to a pupa. About 10 days later the moth emerges from the pupal shell. It is predominantly bronze-brown in colour, three-quarters of an inch long

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* *Plusia argentifera* Gn.

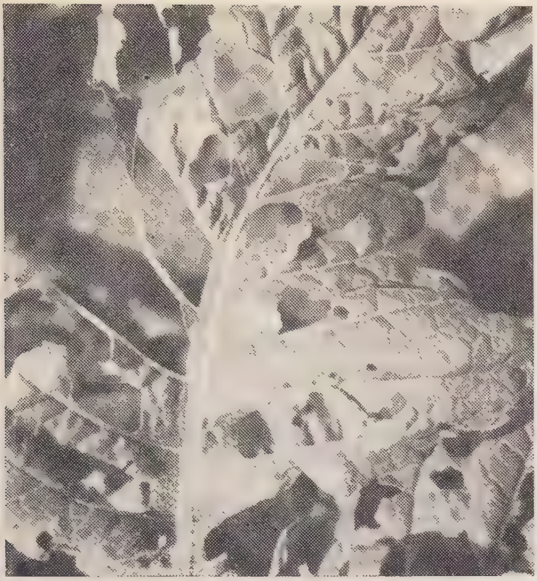

Plate 1

A Tobacco Leaf Damaged by Looper Caterpillars.

when at rest with folded wings, and one-and-a-quarter inches across the expanded wings. The forewings bear small but prominent silver-white marks. Moths shelter in the tobacco or adjacent weeds by day, and after mating, lay eggs on the tobacco at night. Under laboratory conditions more than 100 fertile eggs have been laid by one specimen in 48 hours.

Seasonal Behaviour

Eggs are usually deposited on tobacco during the first 2 weeks after planting out. On September-planted crops, therefore, well-grown grubs may be active later in that month or during early October. Following this activity there is normally a lull and larvae of the next generation may appear in either November or December. A further population peak in summer is rare. This seasonal sequence and the intensity of attacks will vary with temperature and rainfall. Between February and July it is likely that there is a continual but slow breeding of small numbers on other host plants, chief of which are tomato, potato and a wild tobacco.

Control

An insecticide application to be of value against loopers must kill a high percentage of the population, kill quickly and preferably remain effective for some time. On rapidly growing plants it may need to be applied frequently to cover new growth, and regular applications are also necessary where spray irrigation is practised, as this may shorten the persistence of insecticide residues. Complete cover should be the objective—that is, both sides of each leaf should receive a film of insecticide.

Either endrin or dieldrin sprays are effective against the tobacco looper. Application at weekly intervals for 3 weeks ensures protection of the young crop. Subsequent sprays should be timed by observing the young stages on the plants.

Tobacco Budworms*

Tobacco budworms are well known in Queensland on a variety of weeds and crops other than tobacco, and depending on the crop attacked are called corn ear worm, Heliothis caterpillar or tomato grub. The name tobacco budworm is derived from the habit on this crop of eating the

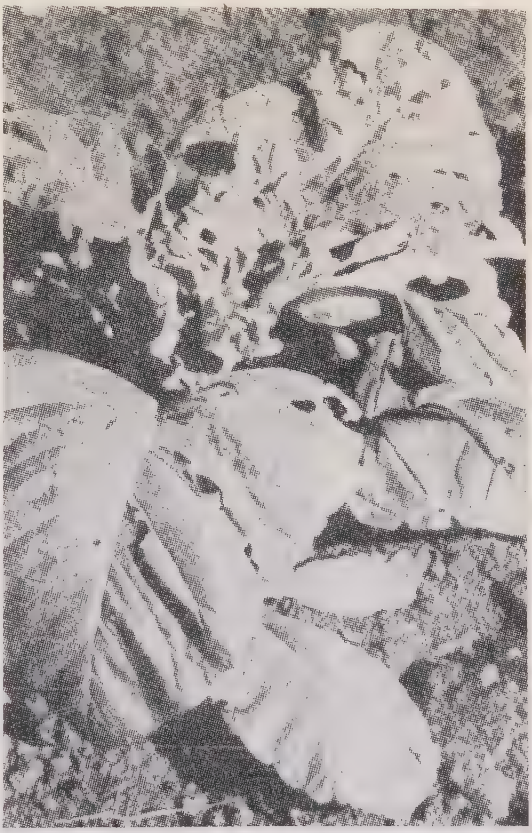

Plate 2

A Tobacco Plant Damaged by Budworm and Looper Caterpillar.

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* *Heliothis armigera* (Hb.) and H. *punctigera* (Wallengr.)

Plate 3

A Full-Grown Tobacco Looper Caterpillar (Magnified).

buds or growing terminals. While feeding can occur on any of the leaves of either seedlings or field plants, the damage to the growing terminals, with consequent promotion of sucker growth before flowering, is much more serious. Once the larva has entered the protection of the bud leaves, it is able to do considerable damage in a short time.

Life History and Habits

The globular egg is slightly smaller in diameter than that of the looper and is pearly-white in colour. The newly hatched larva is watery-white and thicker in the body than the looper. In five or six growth stages taking up to 3 weeks, the caterpillar gradually acquires more body colour and the body hairs become more pronounced. The full-grown larva measures about one-and-a-half inches long, and has a colour pattern in which green, brown or black may predominate. It finally burrows 3 or 4 in. into the soil near the base of the plant, forms a smooth-walled chamber, and pupates. After 10 days or longer the rather drab light-brown moth with indistinct black markings leaves the pupal cell.

Budworms may be found in August seedbeds and large populations frequently occur 2 or 3 weeks after planting in the field. From then on, the seasonal life history is not consistently well defined, but several periods of marked activity can be expected through the cropping season, even on very late planted crops.

Control

Budworms are readily killed by DDT sprays. However, the feeding preference shown for the terminal growth of this rapidly growing crop means that insecticides have to be applied, at least to terminals, at about weekly intervals while the danger of budworm attack is present.

Cluster Caterpillar

The cluster caterpillar* is usually of less importance than either looper or budworms. Although hatching of the young caterpillars occurs in "clusters" of more than 100, the natural death rate on tobacco is high. The larvae eat leaf tissue in much the same way as the looper, but the large numbers of young larvae present may completely destroy one or two leaves on a plant before the survivors migrate to other leaves or other plants.

This pest can be present in August seedbeds and at any time later in the crop, but it is more noticeable from December onwards.

Alternate hosts of the cluster caterpillar are cabbage, tomato, banana, cotton and many weeds.

Life History and Habits

The compact, flat egg cluster is roughly oval, about half an inch long, and covered with light brown hairs from the abdomen of the moth. The larvae leave the eggs and spread out on the undersurface of the leaf to feed. In the smaller

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* *Prodenia litura* (F.)

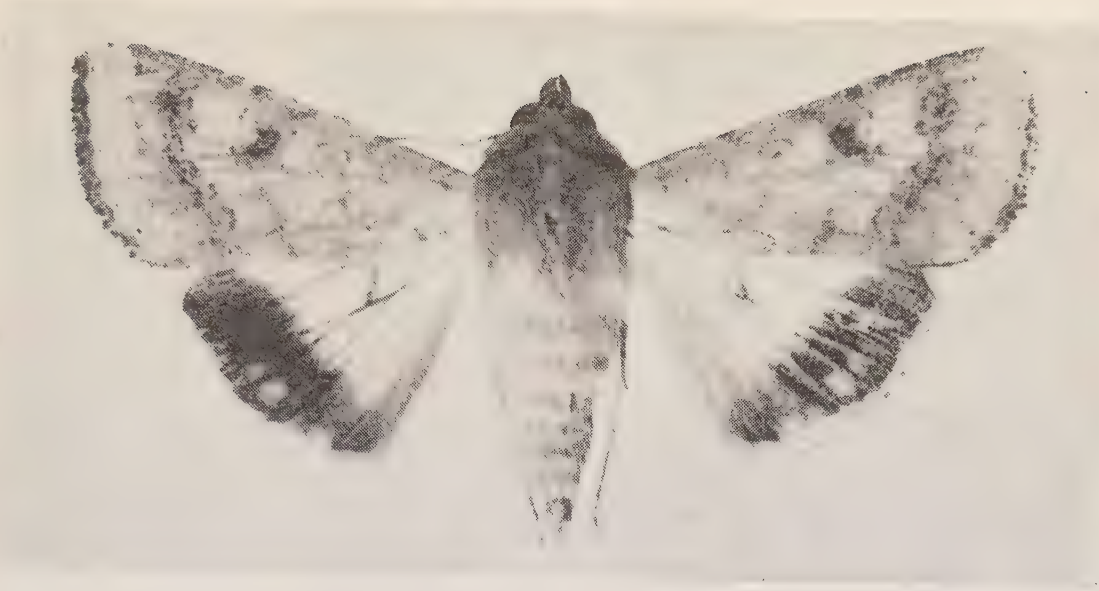

Plate 4: **Moth of the Budworm.**

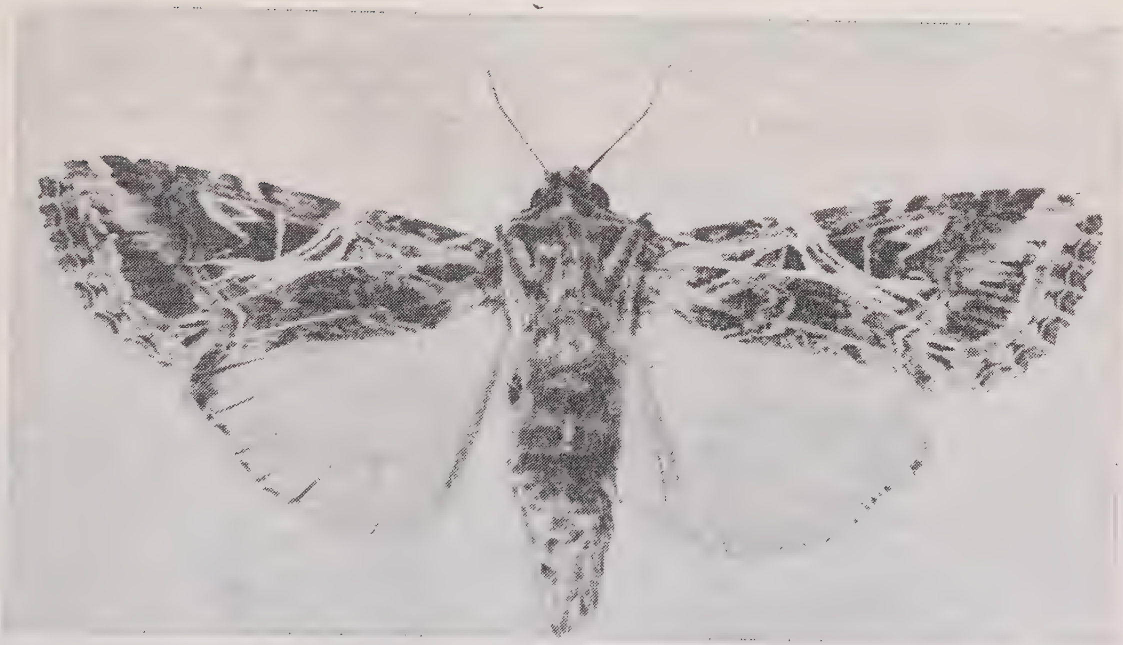

Plate 5: **Moth of the Cluster grub.**

stages they are broadest and dark coloured near the front three pairs of legs. Later a grey-brown colour with conspicuous black triangular marks in a line along each side distinguishes the species. The full-grown larva, almost 2 inches long and proportionately thick, enters the soil and forms a dark-brown pupa from which the moth emerges. The moth has a brown wing pattern, made up of light-brown areas, dark-brown spots and various white lines. The body is three-quarters of an inch long and the wingspan one-and-a-half inches.

Control

Since cluster caterpillar alone is rarely present in tobacco, control is generally achieved by measures taken against other pests. Endrin, dieldrin and DDT are all effective in controlling this pest.

Leaf Miner

The leaf miner* of tobacco, also known as the potato tuber moth, can be a serious pest in seed-beds and in the field. In transplants young leaves may be completely destroyed and terminals badly injured, necessitating replanting. Older plants may have many of the lower leaves damaged, as well as some higher on the stalk. Injury results from the larvae tunnelling between the upper and lower surfaces of the leaf and leaving only the transparent double skin. This leaf mine often runs near one of the leaf ribs but can be quite extensive in breadth. In heavy infestations mining within the leaf midrib and beneath the surface of the main stem is not uncommon.

Plants in which leaf miner breeds are potato, tobacco, tomato, eggfruit, gooseberry weeds, nightshade ("blackberry"), wild tobaccos and thorn-apples.

Life History and Habits

The egg is very small and is usually laid on the soil, although sometimes on the leaf surface. In 4 or 5 days the larva emerges and makes its way to a suitable part of the leaf. It feeds inside the leaf, and in less than 3 weeks in summer passes through four growth stages, the final stage being responsible for most of the mining. This final stage larva varies in colour from pink to grey-green and is about half an inch long. On completion of feeding the larva either forms a silken cocoon to one side of a leaf mine and there transforms to a pupa, or moves from the mine to form the cocoon in the surface soil near the plant. About a week later the moth emerges. The period from egg to adult varies from 3 to 4 weeks in summer. The moth is a rapid flier. It is three-eighths of an inch long, and when at rest the dark-brown speckled wings are folded along the back.

Control

DDT, dieldrin or endrin sprays used at weekly intervals in the seed-bed and during the first 3 weeks of the life of the crop in the field will protect tobacco plants from early leaf miner attack. Treatment should not be delayed until leaf mines are seen, because the presence of nearby potato crops, late winter and spring

Plate 6

Moth of the Tobacco Looper Caterpillar.

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* *Gnorimoschema operculella* (Zell.)

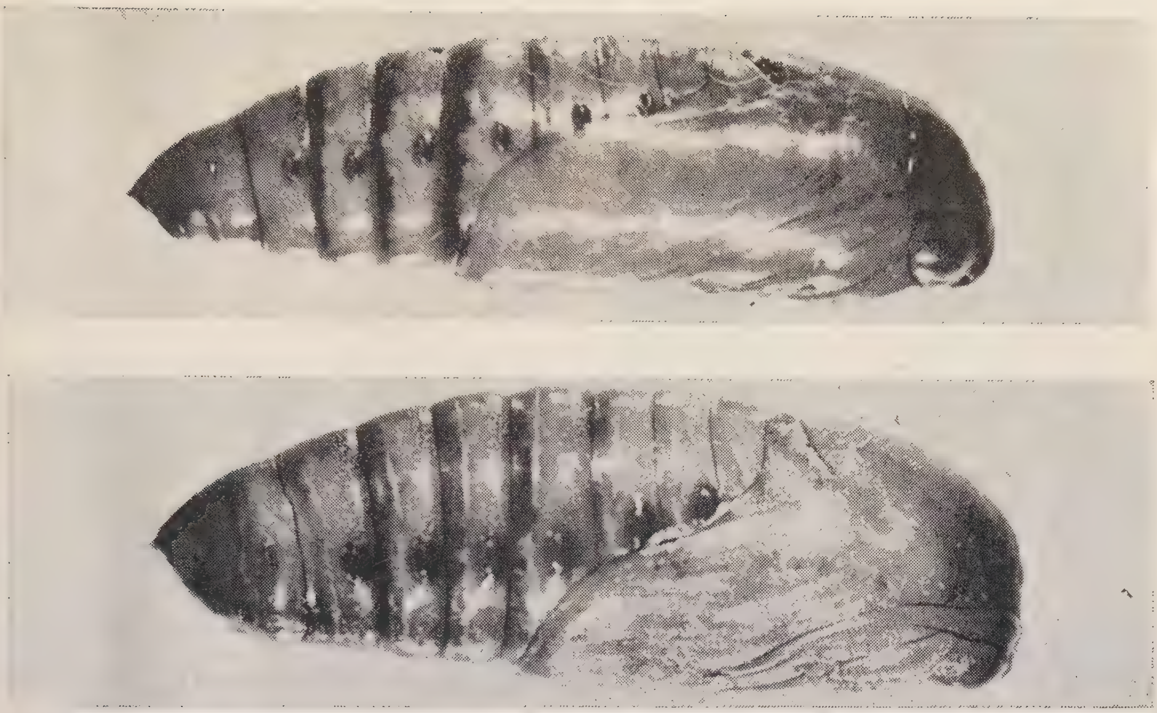

Plate 7

Pupae of Budworm (top) Cluster grub (bottom).

weeds, or volunteer tobacco plants is sufficient in most instances to provide moths to damage the tobacco crop. If epidemic conditions develop requiring special treatment, WL1650 spray may be used.

Root-Knot Nematodes

Root-knot nematodes* are widespread soil inhabiting pests of tobacco in Queensland. As a result of their activities the roots become swollen or galled, conducting tissues carrying plant food and water to the leaves are partly destroyed and in wet soil the galled roots quickly rot. Infested seedlings remain stunted and may die. Older plants yield papery leaf and under hot, dry conditions wilt readily. Tobacco is only one of a long host list for these pests.

Life History and Habits

Eggs are laid in gelatinous sacs attached to the body of the female nematodes. Minute eelworms emerge and move within the root or in films of moisture in the soil. After the females locate a suitable feeding site within a root they remain there, growing through a series of stages. Ultimately they are large enough to be visible as glistening pearly-white globules which protrude slightly from the cut surface of a gall.

Control

Clean fallows, the growing of nematode resistant crops in rotations, and the maintenance of good growing conditions will help towards reducing nematode populations and keeping plants vigorous. Assured regular control of this pest, however, is possible only by using nematode-free seedlings in fields treated, before planting out, with either EDB or DD soil fumigants.

Stem Borer

Closely allied to the leaf miner, the stem borer* is almost indistinguishable from it in the young stages. Its damage, however, mainly takes the form of tunnelling in stems and large midribs, although some leaf mining may occur near tunnelled ribs. In seedlings and young plants the stem tunnelling may cause wilting and destruction

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* *Meloidogyne javanica* (Treub) and *M. incognita* (Kofoid and White).

* *Gnorimoschema heliopa* (Low.)

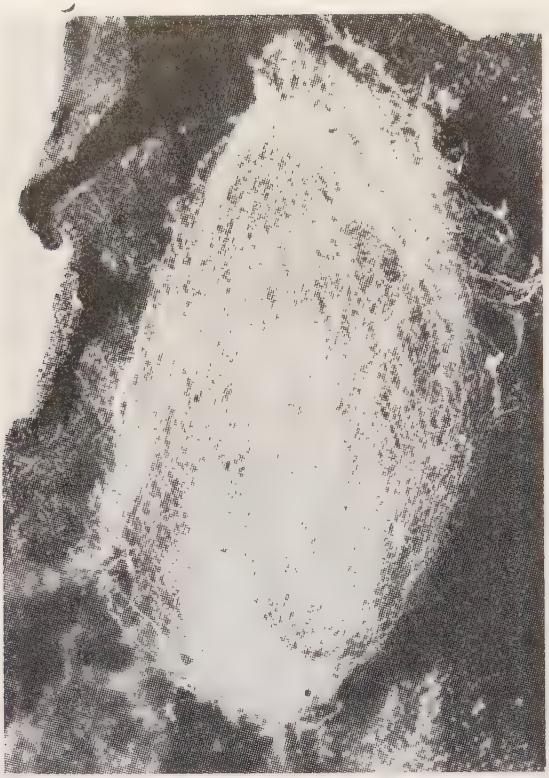

Plate 8

Cocoon Enclosing Pupa of the Tobacco Looper.

of the terminals, while in older plants only individual leaves are affected. As well as wilting, a swollen upper stem is often indicative of the presence of stem borer in seedlings at planting time.

Other host plants of stem borer in Queensland are two species of *Nicotiana* (wild tobaccos).

Life History and Habits

The egg, which is slightly smaller than that of the leaf miner, is laid on the plant and hatches in 4 or 5 days. The larva is very similar to that of the leaf miner, but it takes from 5 to 6 weeks to pass through five larval stages. The pupa is formed inside the stem or midrib where the larva has been feeding, and after a further week the adult pushes its way to the outside through a prepared exit. The moth is much the same in size as the leaf miner moth, but has brown wings.

Control

The treatment recommended for leaf miner will also protect plants from stem borer. Where an attack has begun in young transplants, replanting can often be avoided by breaking off the stem below the affected terminal and allowing one basal sucker to grow.

MINOR PESTS

Cutworms

Cutworms shelter in soil during the day and feed on young plant stems at night, often cutting through the stem at ground level. They are grey-brown or grey-green soft grubs up to one-and-a-half inches in length which curl up when disturbed. One of the commonest species in Queensland is the brown cutworm* which may attack tobacco, cotton, maize and various vegetables in addition to succulent weeds such as pigweeds and bullhead. In tobacco most of the damage is done during the fortnight following transplanting.

A preference is shown for the light-textured, well-drained parts of a field and attacks may be expected on "sandy ridges." Adjacent areas of weeds provide breeding grounds from which cutworms migrate to freshly planted seedlings. Major outbreaks of cutworms usually occur during a dry period following a series of dry years.

Control

Jetting of DDT spray onto plant stems and surrounding soil will control this pest when attacks are observed. Continuous clean cultivation during soil preparation, clean headlands, and the use of hardened seedlings will help to avoid damage.

Wireworms

Wireworms† are hard, shiny, thin worms which inhabit soil; some species feed on plant roots and stems. When tobacco is planted out, the wireworms surviving the destruction of the original host plants and later cultivation may attack tobacco. Plants may die if attacked during the week following transplanting.

The egg, larval and pupal stages of wireworms are passed in the soil and often occupy a period of a year or more. The larva, which is usually less than 2 inches in length, is yellow or brown and may have a rounded or slightly flattened body. The adults are known as "click" beetles.

Control

Control of these pests is difficult and is fortunately rarely needed. Jetting the soil with DDT at the bases of plants in attacked patches offers some degree of control.

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* *Euxoa radians* (Gn.)

† *Elateridae.*

False Wireworms

Two species of false wireworms*, one mainly n southern Queensland, the other in northern districts, damage a variety of plants. Both larvae and adult beetles attack tobacco transplants by nibbling the stem at or near ground level. The critical period is again the first week after transplanting. Tobacco on older cultivated land which has been under weed fallow is more subject o attack than that on new country.

In appearance the false wireworm larva is like a true wireworm except that the rear segment is always rounded. It is less than an inch in length when fully grown, and can be found in the soil close to the stem of the plant. The beetle is oval in shape, grey-black in colour, and nearly three-eighths of an inch long. Both species conform to this general description of larva and adult.

Control

Comments on cutworm control apply also to false wireworms.

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* *Dasus macleayi* Blkb. and *D. carpentariae* Blkb.

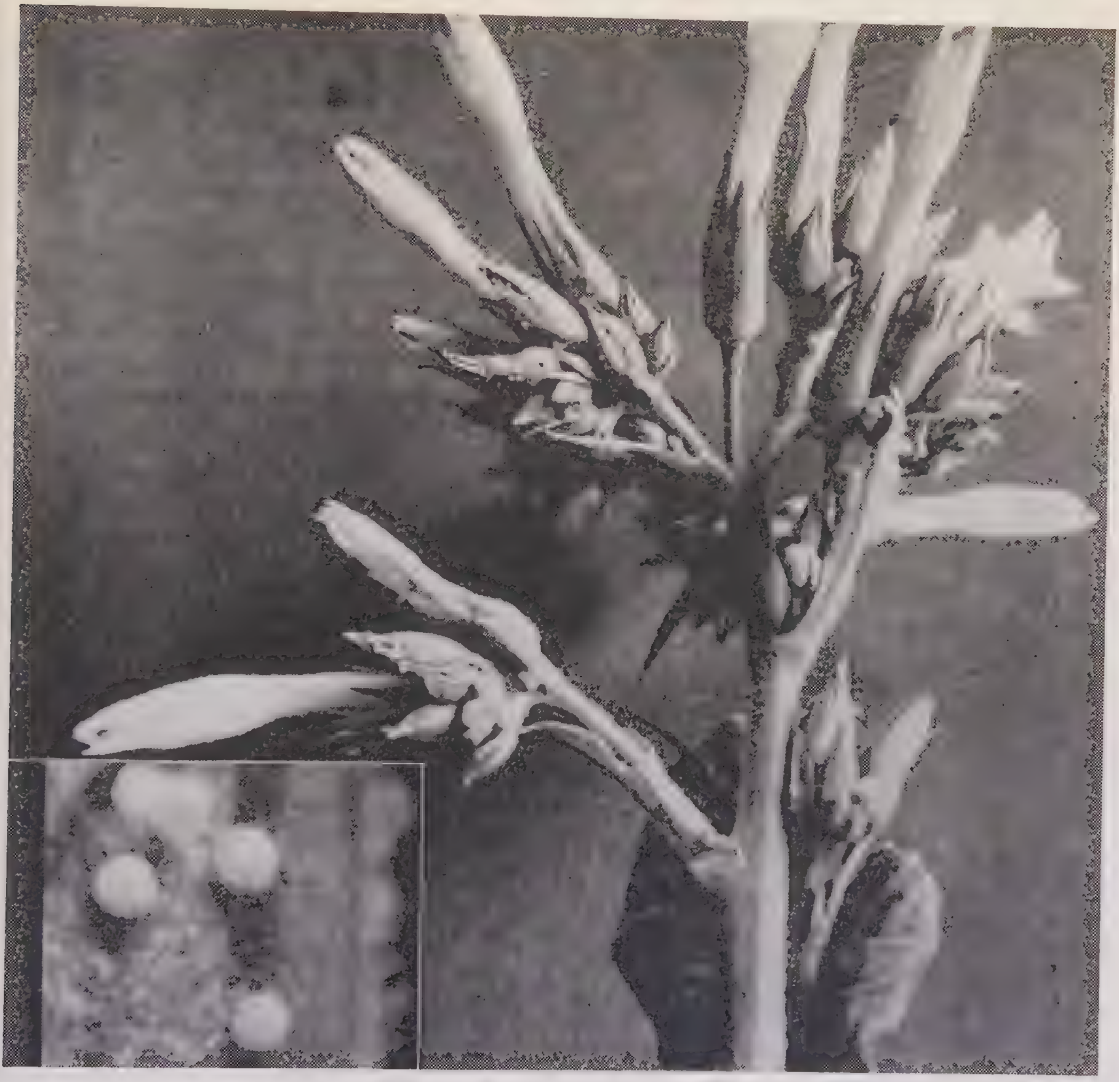

Plate 9

Eggs of the Budworm Moth on Tobacco Flowers. The insert shows part of a tobacco flower with eggs attached.

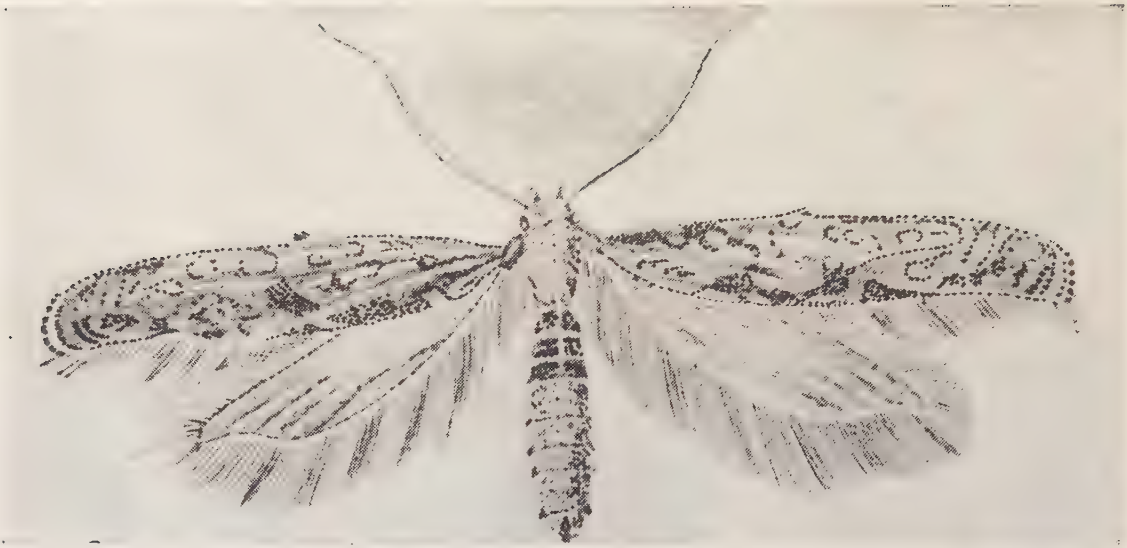

Plate 10

Moth of Tobacco Leaf Miner.

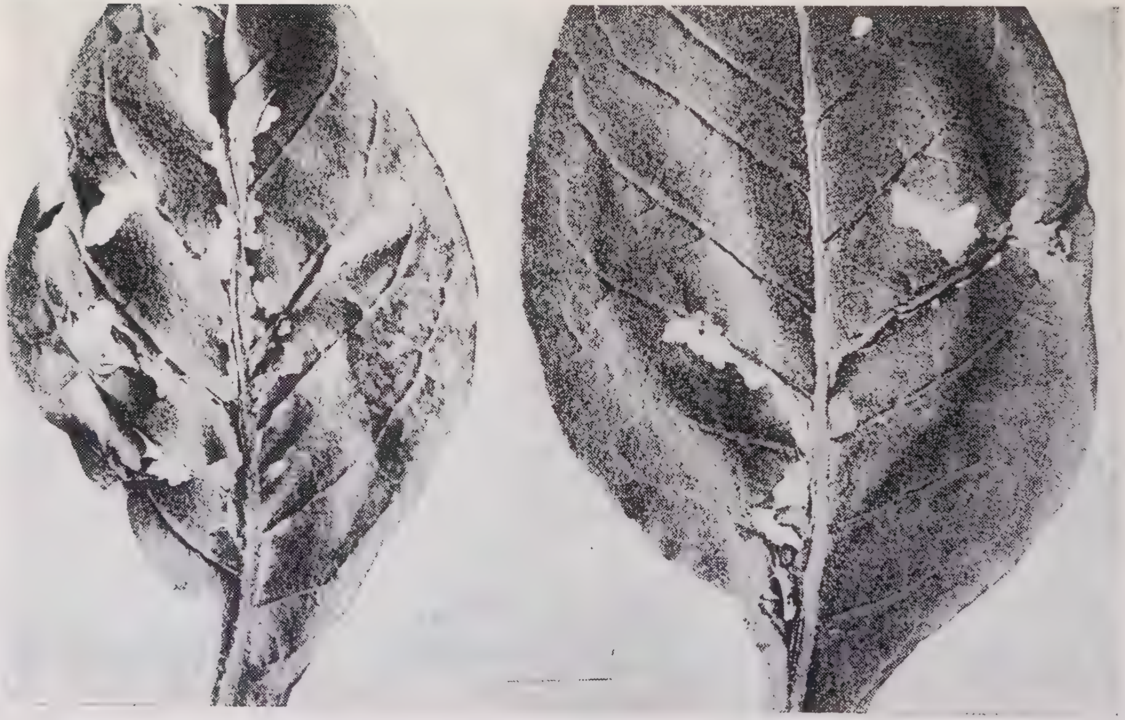

Plate 11

Tobacco Leaves Damaged by Leaf Miner.

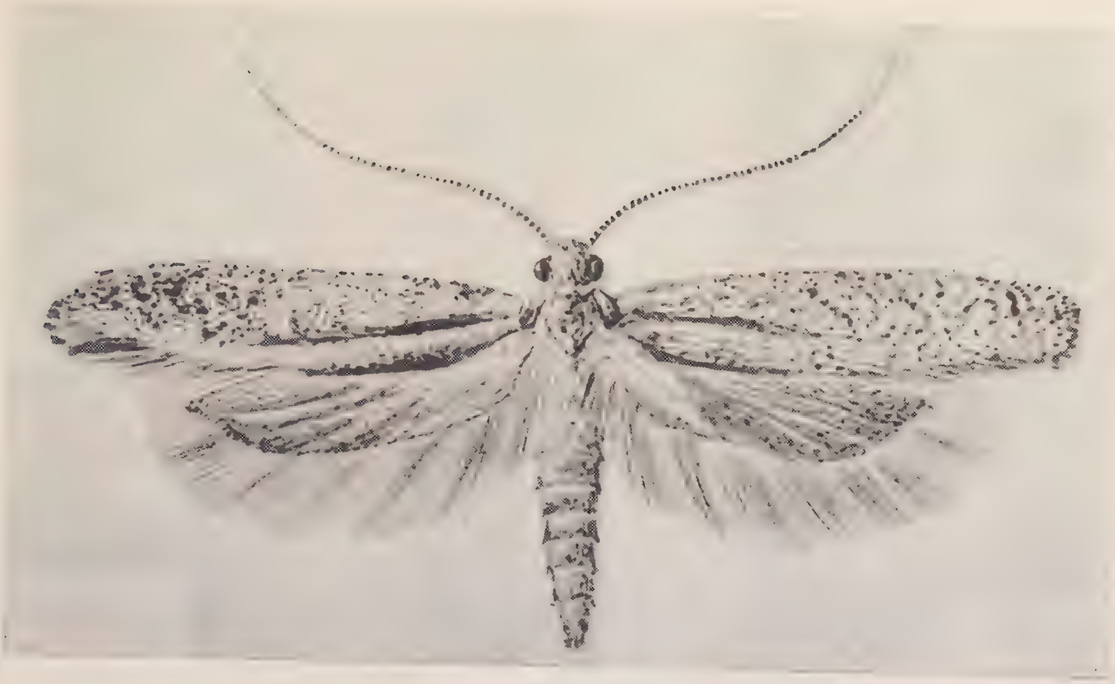

Plate 12: **Moth of Tobacco Stem Borer.**

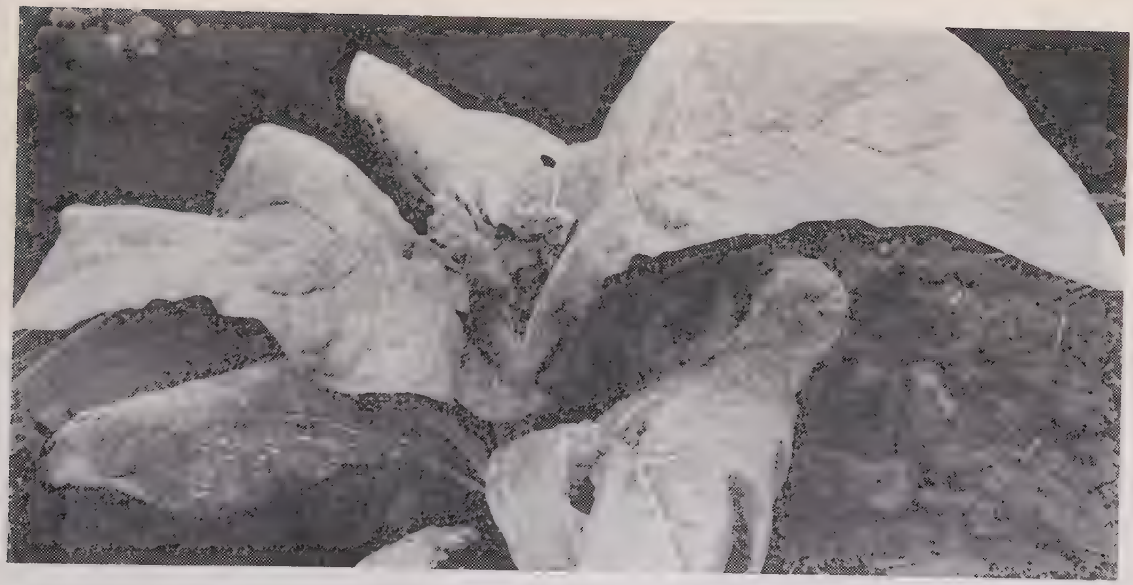

Plate 13: **Tobacco Plant Damaged by Stem Borer (external view).**

Grasshoppers and Locusts

A number of species of grasshoppers† and ocusts† on rare occasions attack tobacco plants. Mild damage by grasshoppers may occur when adjacent grassed areas are infested. Tobacco in the path of migrating locust swarms may be severely damaged.

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† *Acridiidae.*

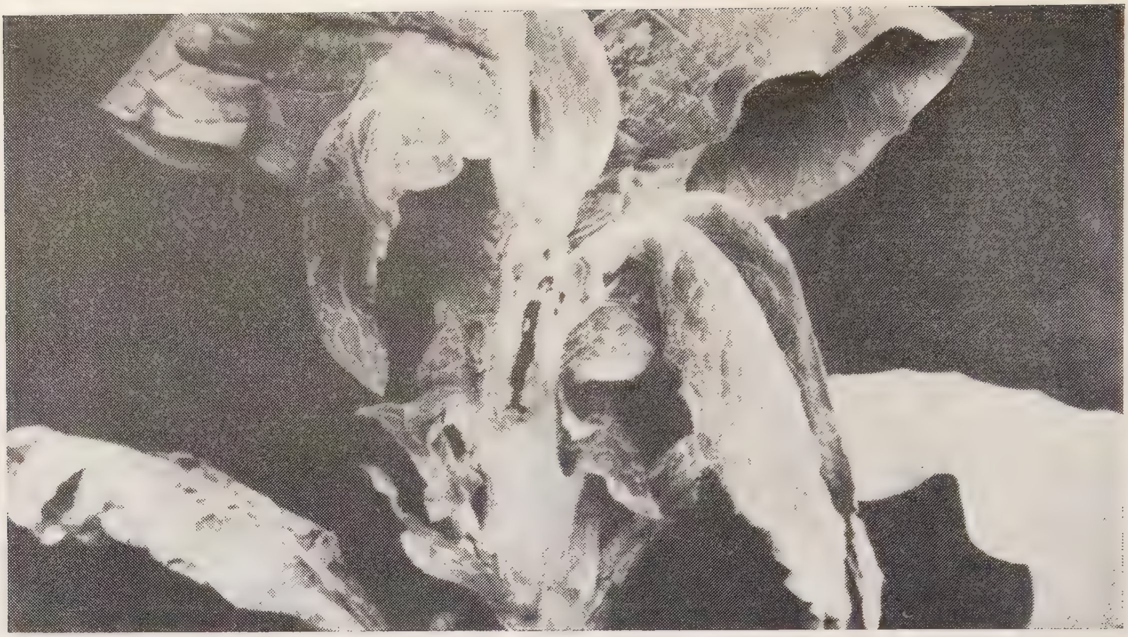

Plate 14
Tobacco Plant Damage by Stem Borer (internal view).

Control

Routine sprays control the rare occurrences of grasshoppers but no economic methods are available for preventing damage by swarms.

Tobacco Thrips

The tobacco thrips* is a minor leaf pest of tobacco in the south-western area. A silvery blemish results from the feeding of the thrips on the upper leaf surface along the veins. The adult insect is greyish-brown in colour and about one-sixteenth of an inch in length, while immature stages are similar in shape but creamy-white in colour.

Control

DDT, dieldrin and endrin, used for other tobacco pests, will control the thrips.

Green Vegetable Bug

The green vegetable bug† is a light green shield bug occasionally found sucking the sap from terminals or leaf petioles of tobacco, causing wilting beyond the point of attack. The damage is usually due to adult bugs flying in from neighbouring fields. Potato, tomato and beans are among the major crop hosts of this pest, which may also breed on a number of weeds.

Control

Should control by insecticides become necessary, DDT sprays are moderately effective.

Mites

Two species of mites causing different types of damage occur on tobacco in south-western Queensland; of these, the red spider mite* has been recorded also in north Queensland.

The red spider mite feeds on the lower leaf surface and spins some webbing in the areas where it is active. Leaves are characteristically blemished by white flecking and may be unusable if damage is severe.

The other mite† is too small to be seen without magnification. It feeds on the leaf surface, beginning on the lower leaves of the plant and causing them to wilt and change to a bronze or red colour.

Control

"Kelthane" sprays are used for the control of mites on tobacco.

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* *Hemianaphothrips concinnus* Mor.

† *Nezara viridula smaragdula* (F.)

* *Tetranychidae.*

† *Vasates lycopersici* (Massee).

Plate 15

Moth of the Brown Cutworm.

Jassids

Jassids,* or leafhoppers, are active insects about one-sixth of an inch in length and usually green. Winged adults and wingless young stages may be found feeding beneath the leaves of tobacco and causing a white fleck blemish where sap is sucked from the leaf. When this pest occurs it is usual for small patches of plants to be attacked.

Control

DDT, dieldrin and endrin, all control jassids when an insecticide is necessary.

Brown Vegetable Weevil

The small, green, legless larvae of the brown vegetable weevil* sometimes feed on seedlings in tobacco beds. The greyish-brown beetles have a V-shaped mark on the back, about one-third of an inch in length. These also can cause damage. Both larvae and adults feed mainly at night or in sheltered situations.

Control

DDT sprays provide adequate control of this pest.

Ants

Various ant species may cause trouble in seedbeds. Seed-harvesting species† carry surface-sown tobacco seed to their granaries. Others cut and remove the leaves of seedlings soon after germination. Mound species may rebuild mounds on the beds after they are prepared and sown.

Control

Seed harvesting will be prevented by lightly covering the beds with river sand after planting. Endrin or dieldrin will control other species, either by jetting into mounds before preparing the area, or lightly spraying beds if leaf-harvesting species become active after germination.

Plate 16

An Irregular Stand of Tobacco Caused by False Wireworm Attack.

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* mainly *Austroasca viridigrisea* (Paoli).

* *Listroderes obliquus* Gylh.

† mainly *Pheidole anthracina* For.

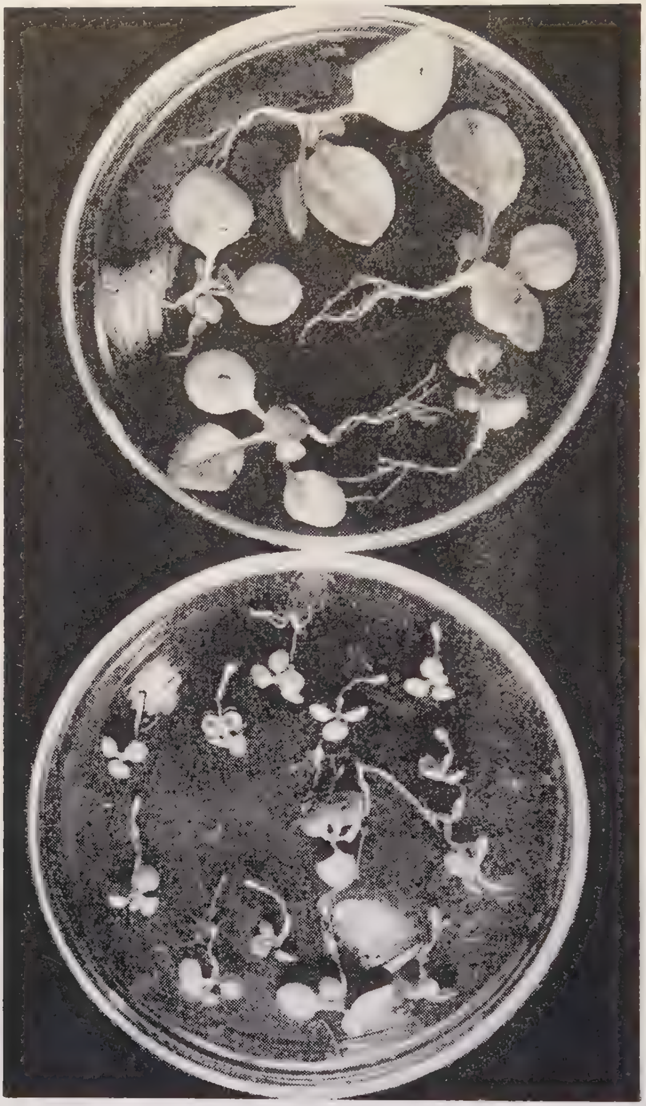

Plate 17

Healthy Tobacco Seedlings (top) and Seedlings Infested by Nematodes (bottom).

GENERAL CONTROL PROGRAMME

Details of treatment programmes and insecticides for the control of tobacco pests in seedbed and field are given in a leaflet published separately, together with the necessary precautions to be taken in using poisonous materials for pest control in tobacco.

A Pest of Cured Leaf

The tobacco beetle* is the most widely distributed and serious pest of cured leaf in farm bulk sheds. It may appear in a new bulk shed from a number of sources, such as breakfast meals and mosquito coils, particularly where

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* *Lasioderma serricorne* (F.)

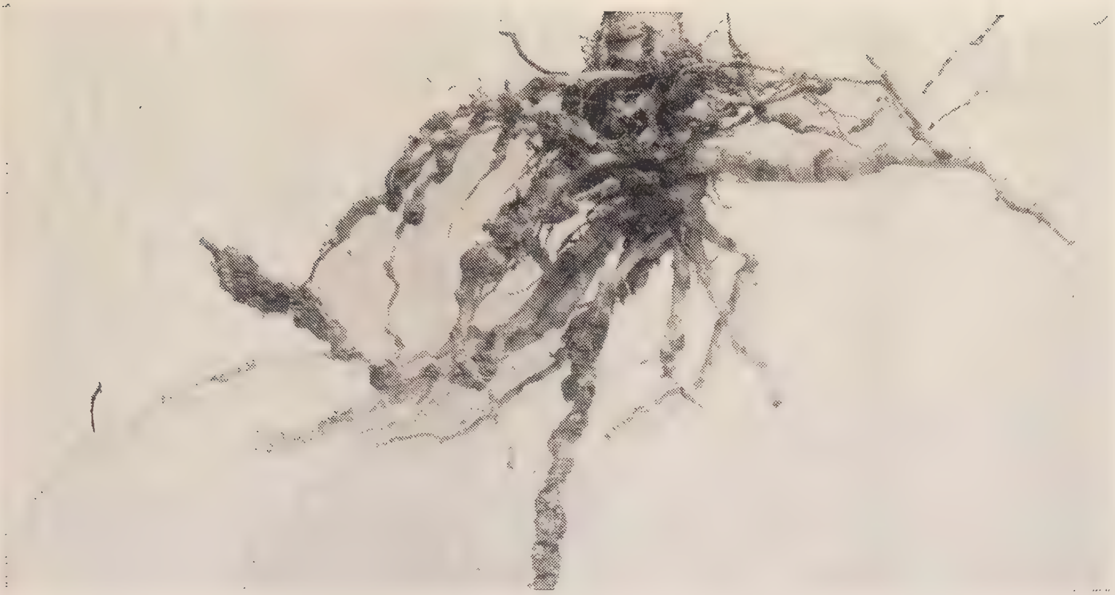

Plate 18

Tobacco roots Heavily Infested with Nematodes.

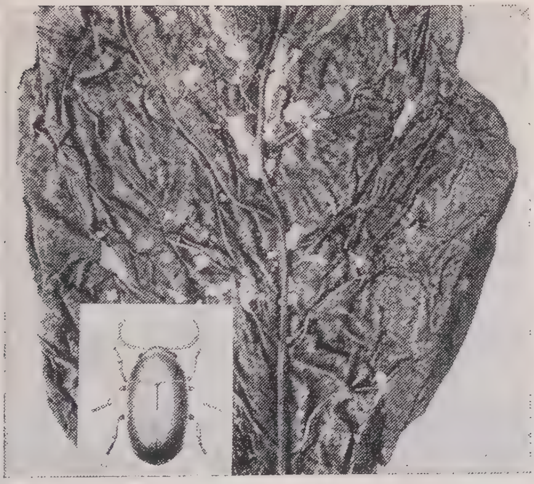

Plate 19

Stored Leaf Damaged by the Tobacco Beetle.

Insert—Tobacco Beetle.

living quarters are built on to the bulk shed. Leaf left in bulks or bales is attacked by beetles and larvae and is eventually riddled and reduced to powder, particularly near the outside of the bulk.

Life History

The beetle lays eggs singly on the cured tobacco leaf. The egg hatches in about a week, and the white, curved, hairy larva begins feeding immediately. Four to 10 weeks later the larva forms a cell and changes to a pupa. This stage occupies a week or more. The adult is oval in outline, brown in colour, and about one-tenth of an inch in length.

Control

Between seasons the bulk shed on the farm should be cleaned thoroughly to remove tobacco debris from both inside and around it. Insecticides used in the empty bulk shed, such as DDT as a dust, spray or swab or BHC as an "odourless" smoke, help to destroy carry-over beetles. If a dust is used, the surplus should be swept up, and as with any treatment the shed should be aired thoroughly. These methods are less hazardous than fumigation.

If leaf is held over from season to season, it should be inspected frequently for tobacco beetle. Infested bulks can only be freed from the various stages of the pest by breaking down and treatment. The most effective method on the farm is to restring the leaf on sticks and expose it in the barn for 2 hours at a temperature between 140 and 150 deg. F.

Fordson Farm Major, Rowcrop Model

Australian Tractor Test No. 33A.

Following is an abridged report of the Australian Tractor Testing Committee on the Fordson Farm Major, Rowcrop Model:—

The tractor used in test No. 33 was converted to the Rowcrop model by the fitting of the alternative wheel equipment.

Performance Summary

1. Governed engine speed ..	1,600 r.p.m.
2. Maximum* belt h.p. rated speed (Test No. 33) ..	39·8
3. Maximum* d.b.h.p. on test track, rated engine speed	35·4
4. Rated† d.b.h.p. under governor control ..	26½
5. Maximum shaft h.p. at rated speed: 43·4.	

Steering, Stability

Track width as tested: Front 52 in., rear 56 in.; wheelbase 80 in.

Turning circles: Outside diameters on consolidated dry gravel surface: No brakes: L.H. 28 ft. 8 in., R.H. 28 ft. 4in.; with brakes: L.H. 22 ft. 4 in., R.H. 22 ft. 0 in.

Steering: Manual, easy and sensitive at all loads.

Centre of Gravity: 6 in. above and 29 in. ahead of rear axle; tested in standard weight condition, including driver and fuel; rear 3,520 lb., front 2,020 lb., total 5,540 lb.

Ground Clearance: With swinging drawbar: 15½ in.; without swinging drawbar: 19 in.

Height of Drawbar: 17½ in.

Tyres, Wheels and Weights

1. *Rear Wheels :*	
Type	Pressed centre, detachable rims
Ballast :	
liquid, lb./wheel	420
solid, lb./wheel	165
2. *Rear Tyres :*	
Size and ply	11 x 38, 6-ply
Make and type	Dunlop Super Trakgrip, open centre chevron tread
Air pressure, p.s.i.	12
Static deflection	2 in.
3. *Front Wheels :*	
Type	Cast wheel
Ballast :	
liquid	nil
solid	nil
4. *Front Tyres :*	
Size and ply	6·00 x 19, 6-ply
Make and type	Dunlop Farm Tractor circular rib tread
Air pressure, p.s.i.	28
5. *Weight of Tractor :*	
Rear, lb.	4,690
Front, lb.	2,020
Total (as tested with operator) lb.	6,710
6. *Weight Condition :*	Maximum
7. *Height of Drawbar :*	17½ in.

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* No atmospheric corrections are applied to diesel engines.

† Rated drawbar h.p. is defined as 75 per cent. of maximum d.b.h.p.

DRAWBAR TESTS. **Tractor running on Tarmac Test Track.** **Note: One fuel setting in all tests.**
Rated gear—3rd

Gear	*At Rated Engine Speed*					*Overload*			*Temp. °F.*		*Barom. Inch Mercury*
	D.B.H.P.	*Drawbar Pull lb.*	*Speed m.p.h.*	*Slip of Drive Wheels %*	*C/Shaft r.p.m.*	*Max. Sustained Pull lb.*	*Limit Set By*	*C/Shaft Speed r.p.m.*	*Radiator*	*Air*	
TESTS F. & G. MAXIMUM D.B.H.P.—All Gears, Maximum weight, standard tyres. Rated gear (3rd) defines max. d.b.h.p.*											
1	24·0	4,750	1·9	17·4	1,700	4,950	wheelslip	1,690	160	58	29·8
2	32·7	4,750	2·6	17·9	1,660	4,950	wheelslip	1,650	160	60	29·8
*3	35·4	3,750	3·5	9·3	1,600	3,950	engine torque	1,200	160	62	29·8
4	36·8	2,700	5·1	6·5	1,600	2,800	engine torque	1,200	160	64	29·8
5	36·3	1,850	7·4	4·4	1,600	2,000	engine torque	1,200	160	68	29·8
6	Not tested										

Get Peak P.T.O. Performance

For peak performance and freedom from mechanical troubles the p.t.o. drive shaft should be checked at the beginning of the season.

Before attaching a machine that has been idle for some time, check it carefully for obstructions. Then turn the mechanism over by hand several times.

The slip clutch in the drive line, either on the p.t.o. shaft or near the drive on the machine, is the next to be checked. If the slip clutch fails to operate, serious damage may result. This clutch may be either the serrated coupling type or a friction disc clutch but both types are apt to become rusted and stuck after a period of storage.

Whatever type of clutch is fitted, it should be dismantled and cleaned. When re-adjusting either type of clutch, start the machine with the tension lightly applied. Then tighten until there is no slipping under normal load.

After checking the slip clutch, carefully examine the universal joints at each end of the drive shaft. If there are any cracked bearing rollers and caps, any distortion of the yokes or any looseness, renew the affected parts.

Before fitting the shaft to the tractor, lubricate all the nipples and clean the splines on the coupling to remove paint and rust. Ensure that the securing bolt or spring plunger is effective and in good condition, especially where an adaptor is fitted.

Adaptors are sometimes necessary to convert the p.t.o. shaft on some older tractors from $1\frac{1}{8}$ in. diameter to the now standard size of $1\frac{3}{8}$ in. If an adaptor is used, make sure it is of good quality and is properly fitted. A power drive shaft coming unhitched at working speed could cause serious damage and injury to the operator.

—*C. G. WRAGGE, Agricultural Engineer.*

Poultry Easier To Handle In Blue Light

By P. D. RANBY, Veterinary Officer.

Birds are blind in blue light. Although this fact has been known for some years, it has only recently been applied to poultry management. Trials using blue lighting at night were carried out on two poultry farms near Brisbane. By the use of this method, catching, culling and vaccinating procedures could be carried out with greater ease and speed.

When using blue lighting, any trace of white light must be excluded. Thus moonlight nights should be avoided when using the method.

Blue bulbs of 25 watt carried on a lead or a 40 watt fixed blue bulb were found to be the most satisfactory. A 60 watt blue bulb tended to cast broad shadows to which the birds showed slight alarm.

At the base of the blue bulb near the metal junction is a narrow colourless zone. Cover this over with a suitable opaque material such as 3/16 in. black insulating tape in order to block the escape of white light.

When using blue light, it is sufficient to light up the area near the operators, although an extra light may be used if desired.

On the two farms, blue light was used for the following operations:

Culling
Vaccinating
Catching and shifting chickens

Culling

On the first farm, a team of two men culled 2,000 hens on the perches at night, using a 25 watt blue light carried on a lead (see Plate 1). The perches were arranged on a sloping frame up to about 7 ft. high so that the operator could move freely below the hens.

One operator examined each hen by hand, moving quickly along the perches. A second man received cull fowls from the first and carried them in groups of five to nearby crates.

During this procedure the birds showed no sign of alarm when approached and examined. The whole operation was carried out with the greatest of ease. In only 1¾ hours, 250 culls were removed from the flock of 2,000 hens.

The culling operation in daylight would have required 8 hours or more to complete as well as an extra man in the team.

Plate 1

Handling Fowls at Night with the Aid of Blue Light. This is a flashlight scene taken during the culling operation on Keenan Bros.' poultry farm, Carina (near Brisbane). The blue light is seen on a lead (lower right). Mr. Jim Keenan is examining the abdomen of a hen for laying capacity and thriftiness. The perches on a sloping frame are an advantage in that the operator can move freely among the hens.

Advantages of the blue light method over daylight culling were as follows:

(i) A team of two instead of three.
(ii) It was not necessary to catch the birds, hence catching equipment was not needed.
(iii) The hens were not upset or disturbed in any way.
(iv) The operation was four to five times quicker.
(v) It was not necessary to shift the birds; in daylight culling, each hen would have been placed outside the pen after being caught and examined.

One disadvantage of the method was the inability to note the true colour of the comb and wattles of the birds in blue light. However, this should not be so serious since culling by feeling the birds is more accurate than culling on appearance.

Vaccinating

On the same farm, blue lighting at night was used when vaccinating 4,000 chickens against fowl pox by the wing web stab method. The chickens were in weekly batches of 1,000 chickens, each batch being vaccinated when 3 weeks old.

Special, self-supporting screens 3 ft. high were used to divide the pen but lower screens could have been used. Under the effect of blue light, chickens do not attempt to fly.

The chickens were first yarded into the part of the pen on one side of the screens, using the ordinary white light. These were then shut off and replaced by a blue light on a lead. The chickens did not run when approached and showed only slight alarm when caught. There was no tendency to pile up in the corners. The chickens were placed on the opposite side of the screen when vaccinated.

For a team of two men, the vaccinating speed was 500 in 2 to 2¼ hours, and for three men 1,000 an hour. This indicates a 10 to 20 per cent. increase in speed compared with vaccinating in daylight.

Shifting Chickens

On a second farm, 1,500 6-weeks-old chickens in three pens were caught and shifted with the aid of a fixed blue light (40 watt). The chickens were caught and placed in nearby crates which were later shifted. The birds squatted and did not move when approached. One man caught each pen of 500 chickens and shifted them 60 ft. in only half-hour. Here the blue light had the special advantage that only one operator could maintain a high speed. In daylight, a team of at least two would have been required.

Later, on this farm, the blue light method was found less effective when carried out on a moonlight night.

When working close to the blue light for some time, it was noted that a "complementary colour effect" was seen when changing back to white light. Objects now acquired an orange hue but the effect was transient, lasting a few minutes. Orange is the complementary colour to blue.

Beekeeping Field Day

Miss Mavis Jorgenson and Neville Malager are Removing Honeycombs from a Beehive at a Field Day at Rockhampton. The field day was part of a beekeeping school organised jointly by the Capricornia Beekeepers' Club and the Department of Agriculture and Stock.

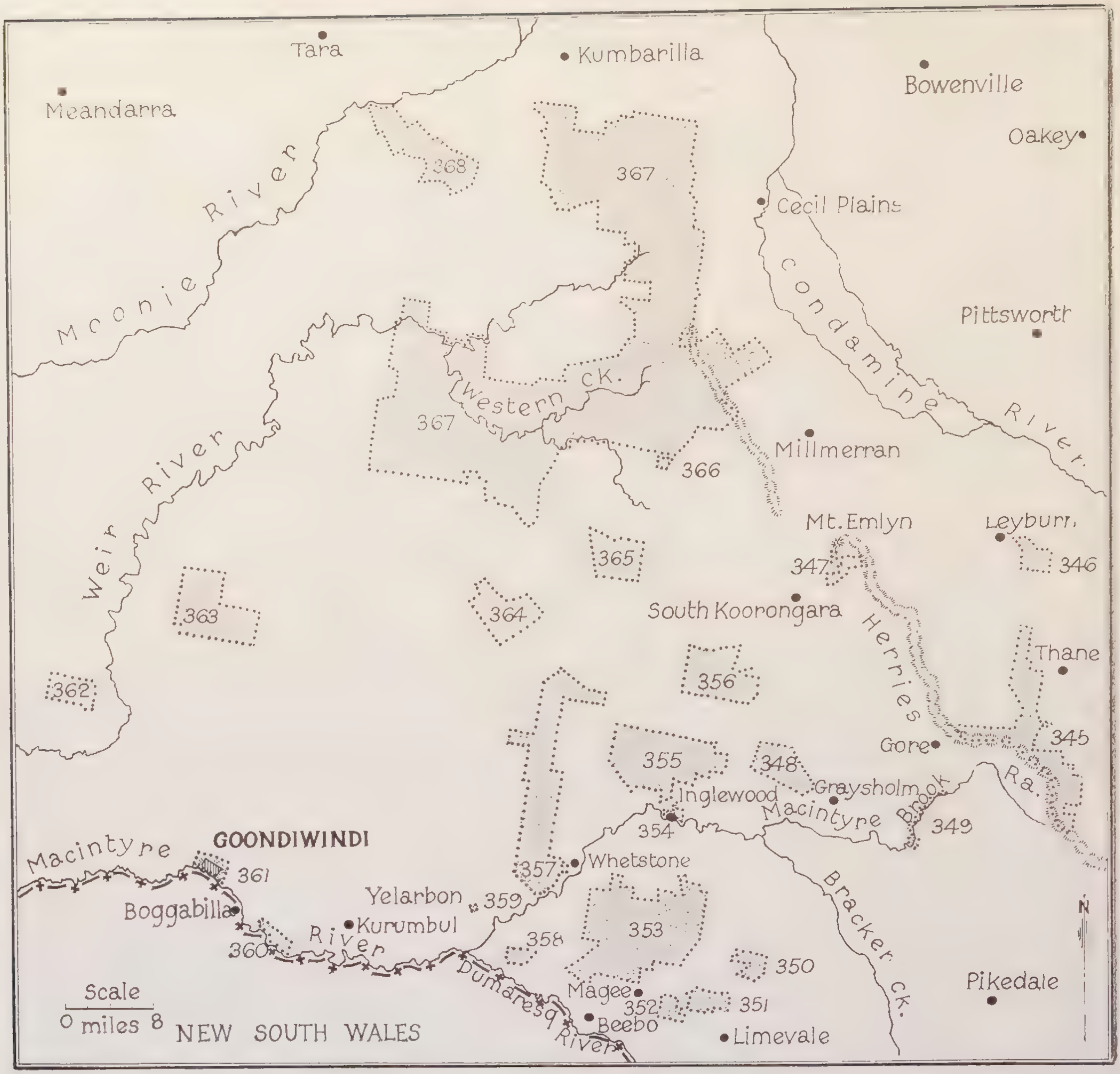
Queensland Fauna Sanctuaries

By C. ROFF, Fauna Officer.

The following is an index of the sanctuaries outlined in Map 26—

Index No.	Sanctuary	Area in acres
345	State Forest Reserves 142, 444, 576, parishes of Herries, Palgrave, Canal Creek, Hanmer, via Thane	35,253
346	State Forest Reserve 574, parish of Leyburn, via Leyburn	5,614
347	Property near Mount Emlyn, via Millmerran	2,554
348	State Forest Reserve 101, parish of Devine, via Graysholm	11,400
349	Macintyre Brook, via Gore	650
350	State Forest Reserve 120, parishes of Greenup, Bracker and Silverspur, via Limevale	4,155
351	State Forest Reserve 13, parish of Texas, via Limevale	5,390
352	State Forest Reserve 132, parish of Texas, via Limevale	2,424
353	State Forest Reserve 81, parishes of Beebo, Tandan and Bracker, via Magee	61,575
354	Town of Inglewood	1,280
355	State Forest Reserve 122, parish of Inglewood, via Inglewood	33,740
356	State Forest Reserve 134, parish of Bringalily, via Inglewood	20,900
357	State Forest Reserve 79, parishes of Eena, Sands, Curriba, Whetstone and Badgery, via Whettone	45,000
358	State Forest Reserve 118, parish of Wyemo, via Yelarbon	2,642
359	Town of Yelarbon	160
360	" Kildonan," Goondiwindi	3,000
361	Town of Goondiwindi	3,520
362	State Forest Reserve 48, parish of Umbercollie, via Goondiwindi	9,761
363	" Billa Billa," Goondiwindi	29,880
364	" Kindon," Goondiwindi	15,412
365	State Forest Reserves 168 and 189, parishes of Bulli and Western Creek, via Millmerran ..	11,951
366	State Forest Reserve 170, parish of Western Creek, via Millmerran	1,159
367	State Forest Reserves 61, 150, 154, 171, 174, 179, 180, 181, 182 and 184, parishes of Boondandilla Bulli, Vignoles, Brigalow, Yandilla, Waggaba, Wilkie, Stretchworth, Halliford and Dunmore via Western Creek, Millmerran	435,769
368	State Forest Reserve 155, parishes of Marmadua and Durabilla, via Tara	63,700

Plate 14. **Darling Downs Sanctuaries Help to Conserve the Useful and Almost Exclusively Australian Marsupial Mouse,** *Sminthopis* **sp.**


Tara
Kumbarilla
Meandarra
Bowenville
Oakey
Moonie River
368
367
Cecil Plains
Condamine River
Pittsworth
Western Ck.
367
366
Millmerran
Weir River
Mt. Emlyn
Leyburn
347
346
365
364
363
South Koorongara
Herries
Thane
362
356
Gore
345
355
348
Graysholm
Brook
Ra.
Inglewood
Macintyre
349
354
GOONDIWINDI
Macintyre
361
Whetstone
357
Boggabilla
Yelarbon
359
Kurumbul
River
360
358
353
Bracker Ck.
N
350
Dumaresq River
Magee
352
351
Pikedale
Beebo
Limevale
Scale
0 miles 8
NEW SOUTH WALES

Map 26

Map Showing Sanctuaries in Part of Fauna District No. 1. The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines enclosing the stippled areas.

High Production: Long Lactation

By C. H. CLARK, Technologist, Division of Dairying.

The following survey shows how high production in dairy cows is related to length of lactation. Reasons why some cows have short lactations are given:

Cows in the highest producing herds recorded under the Agriculture Department's Herd Recording Scheme in 1958–59 milked longer than those in herds with the lowest productions.

This difference was evident in each of the eight herd recording districts of the State and demonstrated the relationships between length of lactation and maximum production.

The results of the survey are set out in Table 1, according to district. The average lengths of lactation of cows in the three top herds of each district are listed for comparison with those of cows in the three lowest producing herds.

TABLE 1

LENGTH OF LACTATION OF HIGH AND LOW PRODUCING HERDS

District	Highest Herds			Lowest Herds		
	A	B	C	X	Y	Z
Atherton Tableland ..	262	273	262	243	250	243
Mackay	263	242	280	128	218	160
Port Curtis	263	264	234	228	196	208
Upper Burnett	261	257	241	221	222	237
Central Burnett	282	261	286	214	242	195
South Burnett	266	271	261	219	210	202
South East Queensland ..	268	268	266	229	219	209
Eastern Downs	274	271	264	220	230	199
Western Downs	252	249	246	222	193	188

Cows in the high producing herds milked at least 8 months or more, while cows in the lowest producing herds had lactations of 7 months or less, except in a few cases where lactation length reached 8 months.

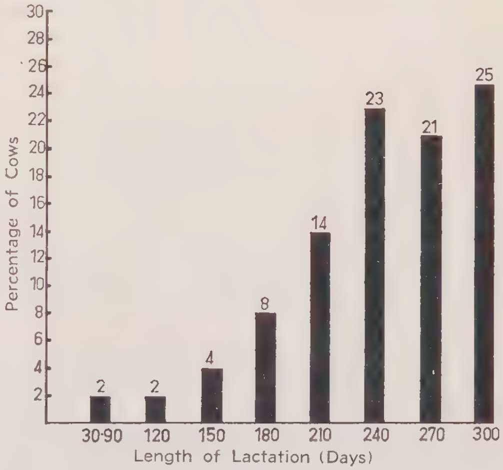


Plate 1

Average Length of Lactation 1958–59 (State Figures).

Average Lactation of Recorded Cows

Although the average length of lactation of cows in recorded herds has increased from 7 months to 8 months in the last 10 years, nearly one-third of recorded animals milk for 7 months or less. An analysis of all recorded cows is illustrated graphically in Plate 1. This shows that 46 per cent. of the cows had a lactation of 9 or 10 months while nearly one quarter (23 per cent.) milked for 8 months. An interesting point is that 12 cows in every hundred completed lactations of 5 to 6 months only.

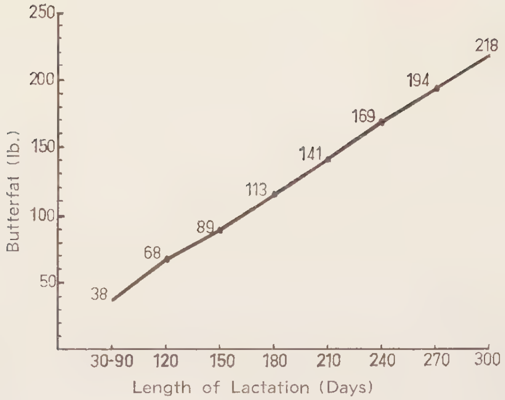


Plate 2

Relationship of Length of Lactation to Production.

Effect on Production and Return per Cow

The way in which length of lactation affects the production of cows is illustrated in Plate 2. The graph shows that during 1958-59 for every month the length of lactation was increased, the average production per cow increased by approximately 25 lb. butterfat.

It is evident that the cows which milked for short periods are not worth retaining in the higher producing herds. If they complete a lactation of 7 months only, they produce (on the average) about 75 lb. butterfat less than those which milk for 10 months. In most cases the same amount of feed is consumed by these short lactation cows, but the return is £15 per cow less.

Reasons for Short Lactations

Cows usually have short lactations because of one or more of the following reasons:

(*a*) *Lack of Feed.*—Most of our herds are dependent on pastures for their food requirements.

Pastures provide sufficient nutrients to maintain production during the summer months, but their period of high nutritive value depends largely on management practices such as mowing, strip grazing and rotational grazing. Under normal seasonal conditions supplements should be fed during many months of the year. Grazing crops, improved pastures and the feeding of grains, silage or hay are the main supplements during dry periods in the winter months.

(*b*) *Uncontrolled Mating.*—If cows are to calve at intervals of 12 months, then the herd sire must be controlled. A period between calving of 12 months allows a normal lactation of 300 days and a dry period of 6 to 8 weeks. When the bull is segregated from the herd a seasonal calving programme may be maintained so that the early portion of a cow's lactation coincides with the period when the best natural feed is available. Herd Recording information has indicated that the length and conditions of a cow's dry period greatly influence her subsequent production record.

(*c*) *Time of Calving.*—Information taken from the 1958-59 recording year results shows that length of lactation depends on the month of calving. This is demonstrated in Plate 3, which shows that cows which calved both early in 1958 and late in the same year milked for shorter periods than cows which calved in other months of the year.

(*d*) *Disease.*—Herd wastage surveys have shown that infertility and mastitis are the two main diseases which result in disposal of dairy cattle from Queensland herds. Although it is known that these diseases are responsible for about 3 per cent. of cullings in recorded herds each year, their effect on production of those affected cows which have not been culled has not been determined.

(*e*) *Inheritance.*—Some strains of dairy cattle appear to inherit the factors responsible for short lactations. These strains should be eliminated from the herd. A close watch should be kept on the daughters of each sire to determine quickly if he is introducing this characteristic.

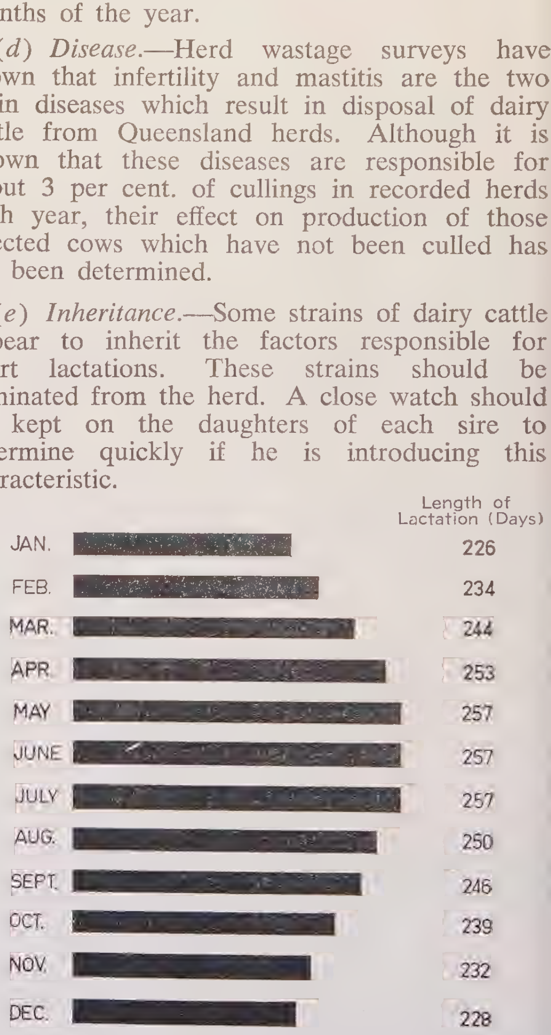


Plate 3

Effect of Month of Calving on Length of Lactation, 1958–59 (State).

Brucellosis-Tested Swine Herds (As at 1st February, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., Ascot, via Greenmount
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Clark, L. D., Greens Creek, Gympie
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton" Stud, Maleny
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warra", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Mannuem Brae" Stud, Mannuem, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
ones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yaralla" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Skyring, G. I., "Bellwood" Stud, via Goomeri
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Wieland, L. C. & E., Lower Cressbrook, Toogoolawah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Campbell, P. V., "Lawnhill" Stud, Lamington
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Helidon
Wieland, L. C. & E., Lower Cressbrook, Toogoolawah

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kunawyn", Acacia Rd., Kuraby
Kingsford, D., "San Antone", Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., Killarney
zstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
ensen, A. P., & Grace, V. S., Theodore
ones, K. B., "Cefn", Clifton
ajewski, W. & Son, "Glenroy", Glencoe
ath, E. E., "Topcamp", via Toowoomba
Kingsford, D., "San Antone", Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Pointon, E., Goomburra, M.S. 869, Allora
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Tuberculosis-Free Cattle Herds

(As at 1st February, 1961)

Aberdeen Angus

Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu
Wilson & McDouall, Calliope Station, Calliope

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Plate 1

A Banana Plantation in Southern Queensland. In the subtropics, bananas are grown mainly on the eastern slopes of the coastal range.

Banana Growing in Queensland—I

Contributed by the Horticulture Branch.

Bananas rank next to pineapples as Queensland's leading tropical fruit crop. Their range extends from Cooktown to the New South Wales border, but production is highest in the south-eastern corner. This two-part article describes banana growing in both northern and southern Queensland.

The banana (*Musa spp.* fam. *Musaceae*) is an important food crop in most parts of the world between the latitudes of 29 deg. N. and 29 deg. S. In Queensland, it is grown along the whole of the coastal strip from the New South Wales border to Cooktown, a distance of some 1,200 miles. At the present time, however, most of the crop is produced south of Gympie, mainly because of the proximity of this area to the metropolitan markets of Brisbane, Sydney and Melbourne. The area of bananas in Queensland actually in production is about 12,000 acres.

The banana is a broad-leaved herbaceous perennial plant which flourishes in warm, moist, sheltered situations with a well-drained, fertile soil.

The Corm

The true stem of the banana is a condensed rhizome known as a "corm." It is a thick massive underground structure with rudimentary or scale leaves. The roots arise mainly from the sides but also from the base of the corm. Suckers or offshoots are produced from buds in the axils of the scale leaves. Plant foods are stored in the corm mainly in the form of starch.

As in all monocotyledons, the roots of the banana are relatively long, cordlike and fleshy. The roots do not thicken and form wood with age and, although tough, are nevertheless easily damaged. Near the end of the main roots are the fine secondary roots known as hair roots.

The Leaves

The part of the plant commonly referred to as the trunk or pseudostem is made up of the expanded leaf bases which support the crown of the plant several feet above the ground. The leaves are broad, undivided, and emerge in succession at the top or "throat," each with the blade rolled round the strong fibrous midrib.

The total number of leaves produced by a plant before it bunches ranges from 35 to 40 or more. The last two leaves produced are shorter than those preceding them, the final one being extremely short and having a tendency to hang over the flower bud. In addition, the flower stalk itself bears one or more elongated sheathing structures called bracts.

Flowers and Fruit

The flower buds are initiated at the growing point of the corm. The corm then forms an aerial stalk which carries the inflorescence up through the pseudostem to the top of the plant. As the stalk elongates, it carries up with it the last few leaves. At its tip is the inflorescence, which later forms the bunch and finally hangs vertically with the distal end pointing downwards.

The flowers are grouped in double-row clusters known as hands. These are arranged spirally around the stalk, the number of flowers in a hand varying from 10 to about 25. Each hand is subtended by a reddish-purple or green bract and development proceeds from the base upwards, each bract in turn lifting to expose the flowers underneath.

As the inflorescence moves up the pseudostem, flower differentiation takes place. The female flowers at the base of the bunch produce the fruit and may account for 12 or more hands. These are followed in series by hermaphrodite and male flowers. The hermaphrodite flowers may form a cluster of short rudimentary fruits, immediately below the last true hand of fruit but in some varieties these are mostly deciduous. The cluster of male flowers at the tip of the bunch is known as the "bell."

The cultivated banana is parthenocarpic, that is, the flowers produce fruit without being pollinated and the fruit is normally seedless.

In southern Queensland the so-called initials or foundations of the bunch are laid down within about four months of planting. The availability of plant foods at that time, therefore, determines the total number of fruit which can be formed. During the later development of the embryonic bunch, however, both food reserves and climatic factors influence bunch development and fruit filling.

Bunch size and fruit shape therefore vary from month to month. November-thrown bunches, for example, usually have comparatively few hands and very short fruit which become correspondingly fat and "dumpy" as they fill. The condition is not well known in the tropics, where winter temperatures are higher than in Southern Queensland.

Varieties

The main characteristics of the more important commercial varieties of banana in Queensland are given below (measurements are only approximate):—

Cavendish.—Pseudostem 6 ft. high; green but heavily pigmented. Leaves 5 ft. long and up to 30 in. wide; stalk short and sturdy. Bunch medium to large with 8–12 hands; compact and tapering. A very popular variety which is resistant to Panama disease.

Mons Mari (*Williams Hybrid*).—Pseudostem 8-12 ft. high; green but heavily pigmented; somewhat thinner than Cavendish. Leaves 8 ft. long and up to 36 in. wide; stalk moderately long and sturdy. Bunch long and cylindrical with 10-15 well-spaced hands. A tall mutant from Cavendish which requires propping when carrying a bunch.

Lady Finger.—Pseudostem 12-16 ft. high; bright green with little pigmentation. Leaves 10 ft. long and up to 36 in. wide; light green and slightly drooping; stalk long and sturdy. Bunch medium, with 5–8 hands of short, thick and rather angular fruit. A tall variety which is tolerant of cool weather and does not require propping. Susceptible to Panama disease.

Sugar.—Pseudostem 10–12 ft. high; slender; light green and slightly pigmented. Leaves 7–8 ft. long and up to 24 in. wide; stalks long, slender and tinged with pink. Bunch usually small with 5–6 hands of short, thin-skinned fruit which has a sweet flavour. Very susceptible to Panama disease.

Lacatan.—Pseudostem 16–18 ft. high; tapering; light green with some pigmentation. Leaves 10 ft. long and about 30 in. wide. Bunch long and cylindrical, with well-spaced hands; fruit abruptly curved at base. Requires a sheltered situation as propping is impracticable.

Selection of Land

Important factors in the selection of land for bananas are a rainfall of 50 to 100 in. a year, high soil fertility, and a subsoil which, while not impeding drainage, holds sufficient moisture to tide the plant over dry periods whenever they occur. These conditions are best satisfied by virgin soils. Frequently, therefore, bananas are handled as a developmental crop on newly cleared land.

Suitable banana land occurs in both rain forest and open forest associations. When derived from basalt, the soil may be stony on the surface. Tall straight softwood timbers such as carrabin, crow's ash, bolly gum and cedar are typical of this type of country in high rainfall areas.

Basaltic soils now under pasture may, if necessary, be used for bananas, provided the area can be ploughed. Slopes formerly used for bananas and now covered by lantana and sapling regrowth up to several years old may also be cleared and planted to the crop. In both cases, heavy applications of fertilizer are needed for maximum production.

Plate 2

Land Cleared and Ready for Planting Bananas. In virgin land, the standing timber must be felled and burnt before planting. Production costs are at a minimum in plantations established on such land.

If the aspect is suitable and the plantation is managed efficiently, payable crops can be produced on land classed as open forest. Trees such as bloodwood, grey gum and tallow wood, especially if accompanied by dense undergrowth, are indicators of a moderately deep, well-drained, friable loam. Soils supporting mahogany, turpentine or spotted gum tend to be shallow and erode rapidly if adequate precautions are not taken to control run-off in wet weather.

Alluvial soils vary considerably. Some are relatively heavy silts overlying a porous subsoil; others are heavy loams overlying clay. Except in very wet areas, the light-textured alluvials are of little value for bananas unless the crop can be irrigated and fertilizers are regularly applied. The heavy-textured alluvials are capable of producing good crops of bananas if care is taken to provide the requisite drainage.

Selection of Site

The banana plant requires ample moisture and relatively high temperatures for its best development. Both are influenced by the elevation, aspect and natural shelter in the plantation. Freedom from frost is essential, but tall varieties are rather more tolerant of cold conditions than the dwarf and semi-dwarf types. This tolerance of cold conditions is mainly due to the rapid growth of the plants during the first year after planting; throat and leaves are well above ground level,

Plate 3

The Cavendish—a dwarf variety that, although still widely grown, has lost popularity in recent years.

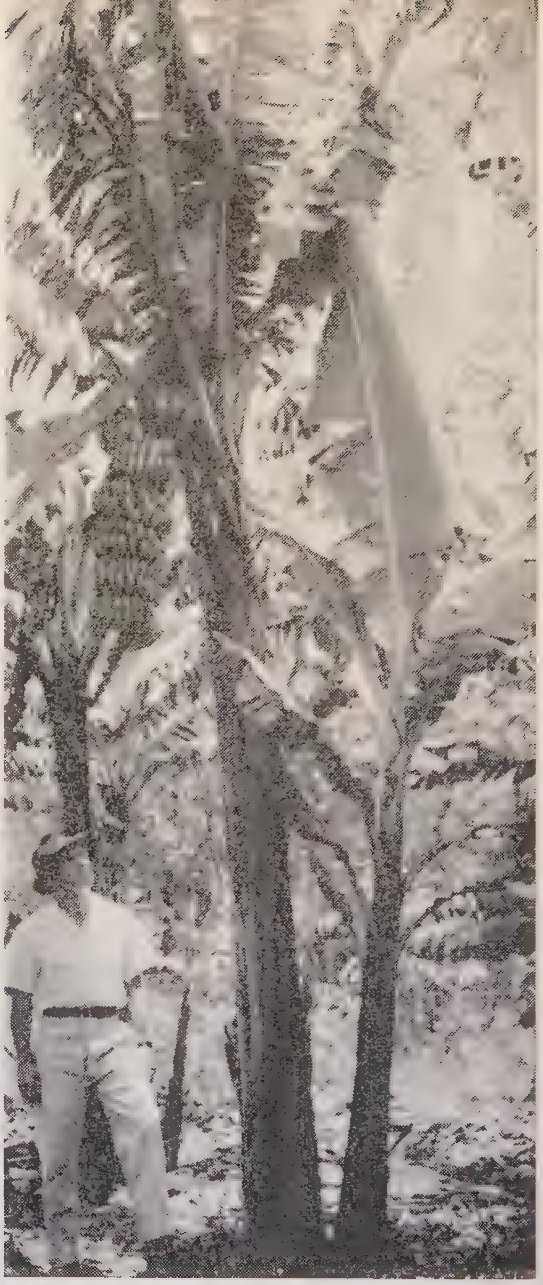


Plate 4

Mons Mari—a semi-dwarf variety which originated as a sport from the Cavendish and is now widely grown.

where cold air accumulates at night in the winter months. The main effects of chilling are retarded plant growth, delayed bunching and blemished fruit.

Tops of ridges should not be cleared for bananas if wind damage is likely to occur. Except in north Queensland, where aspect is not important and planting on level ground is desirable, plantations should face from east to slightly west of north. Such aspects are naturally moist and warm, since they are open to the morning sun and protected from strong southerly and westerly winds by either topography or natural timber.

Land Preparation

In virgin rain forest or scrub, the undergrowth is usually brushed and the standing trees are felled from April to June to allow ample time for the timber to dry out before burning-off between September and November. In open forest, clearing may be delayed until June or July, since most hardwood trees burn well within a few weeks of felling. In replant land, the lantana is brushed and young saplings are cut down about six weeks before the actual burn when, if the day is calm and sunny, an effective clean-up can be expected. Old pasture land should be rough-ploughed across the slope during the early spring and as much grass as possible worked out of the soil before planting; blady grass and bracken must be grubbed out with a sharp mattock.

Contouring

As bananas in the main producing areas are very largely grown on steep slopes, steps must be taken to minimise soil erosion by controlling the flow of surface water during periods of heavy rain. Contouring is, therefore, a necessary practice in most banana districts.

In preparing land for contour planting, it is first necessary to construct a contour drain above the proposed plantation site to divert surface water to a suitable outlet such as a grassed gully. Below this diversion drain the banana rows are marked out on near-contour lines with a fall of 2 ft. in 100 ft., and shallow drains are dug between every two adjacent rows of bananas to carry surface water slowly from the plantation. These drains usually lead to the same natural waterway as the diversion drain.

In new plantings, the plant rows are spaced at intervals of 9–14 ft., depending on the requirements of the variety to be grown.

An alternative method of marking out the area is to form the contour drains first and then set out rows between each pair of drains in the most practicable way. If the drains are several degrees off parallel, as they often are, it will be necessary to provide one or more short spur rows to maintain the required plant and row spacing. In order to avoid awkward spur rows, it is sometimes preferable to construct the contour drains and then plant the area on the square system, moving the stool position slightly uphill whenever it coincides with a drain.

Land Reconditioning

Old banana land is often allowed to develop a natural cover of lantana, a plant which is usually slow to establish itself and difficult to remove when the land is required for replanting. A tall perennial legume, such as pigeon pea, which makes rapid growth when the bananas are eradicated and enriches the soil during the resting period, is much more effective.

If the plantation is to be eradicated in winter, pigeon pea is sown at the rate of 8 lb. per acre in the preceding September or October. The seed may be broadcast and then ploughed or rotary-hoed into the ground. On relatively steep slopes where implements cannot be used, the seed may be hand-hoed into the ground at a rate of approximately 16 lb. per acre. When the plants are 12 months old and the first crop of seed has been harvested, the pigeon pea is either disced or cut back to 18 in. above ground level. Regrowth will soon renew the ground cover and within a few months the plants will be 9–10 ft. high. The dense stand of pigeon pea effectively smothers out most weeds. The crop may be left on the area for several years until the land is required for replanting.

When bananas are to be planted again, the pigeon pea is brushed to ground level about three months before planting begins. In this period, the mulch decomposes fairly rapidly and planting is relatively easy. Under no circumstances should the brushed material be burnt. Any regrowth which appears after the bananas are planted can be grubbed out during routine cultural operations.

Planting Material

Planting material should be obtained from reasonably mature, vigorous plants in an area which is free from the more important diseases and pests. Three types of planting material may be used—butts, suckers and bits.

Plate 5

Lady Finger—a tall variety, the fruit of which is in strong demand throughout Queensland.

Butts.—A butt is obtained by removing the corm together with a portion of the pseudostem from a plant that has recently matured a bunch or, if the plantation is scheduled for eradication, is carrying a bunch or is just about to produce one. The pseudostem is severed about 4 in. above the corm and the corm itself is trimmed. All eyes or buds except one are gouged out and the butt is then planted so that the junction of the corm and pseudostem is about 6 in. below ground level. A butt may be 10 lb. or more in weight; on hilly country where bananas are frequently grown in southern Queensland, this presents an appreciable transport problem. Planting of butts is now seldom practised.

Suckers.—Suckers are offshoots from the parent plant. They make excellent planting material provided they are sturdy, of the current season's growth and retain the narrow "sword" leaves until they are at least 18 in. high. Persistent sword leaves are an indication of plant vigour. Suckers up to 2 ft. high with a large corm and a tapering pseudostem are preferred in practice. Small suckers with spindly stems and broad flattened leaves lack vigour and should be discarded as unsuitable for planting.

Suckers are the most widely used planting material, chiefly because they are easy to remove from the parent plant with a draining spade or sharp crowbar. They are planted with the junction of the corm and pseudostem approximately 6 in. below ground level.

After planting, the sucker often develops a secondary corm on top of its original one and the plant is then comparatively shallow-rooted.

Bits.—A "bit" is a portion of a corm carrying a mature bud or eye. The best quality bits come from well-grown, healthy plants at least six months old and preferably older, which have not yet bunched. The pseudostem is usually cut off about 4 in. above the corm before the butt is dug out and trimmed.

In dwarf and semi-dwarf varieties, only two bits should be cut from the one corm. The buds are located by carefully removing the outer ring of leaves to expose the pink edges of the next pair of leaves. One bud will be found at this point and the other is approximately opposite to it. The corm and attached pseudostem is then split in half so that each half possesses one of these two buds centrally placed. The original growing point and any lower buds are gouged out and the two bits are trimmed with square sides and base to facilitate handling and planting. Prepared bits may weigh 2–4 lb., but the larger that they can be cut the better. The upper buds are very susceptible to bruising and it is usual to leave a small flap of covering tissue as a protection during transport and planting.

Bits are considered the best type of planting material available owing to their normally rapid growth, the deep rooting system and the particularly even stand which develops from them. If soil moisture is very low at the time of planting, however, and irrigation is not possible, bits are less likely to "take" than suckers planted under the same conditions. The bit should be planted in an almost vertical position with the eye about 6 in. below soil level. In heavy soils, shallower planting may be preferable.

Planting material, whether suckers or bits, should be graded into at least two, and preferably three, groups for size and then allowed to stand for at least 24 hours before planting. During that period, the cut surfaces dry out sufficiently to prevent any subsequent breakdown. Each grade of bits or suckers can be planted as a block in the new plantation, in order to give reasonable uniformity to the stand.

Planting

In a warm, moist, equable climate the banana hrows its bunch in about 12 months, but the eriod varies from one district to another and ven within any given district depending on the articular aspect of the plantation and the prevailng climatic conditions.

In southern Queensland, planting takes place rom September to January, but usually mid-December to early-January plantings produce the est results. The aim is to get the plants well stablished with 3–4 months' growth before the nset of cool weather. The initiation of the nflorescence then occurs before winter when limatic conditions are favourable for the production of good-sized bunches. As a general rule, he taller varieties such as Lady Finger are planted omewhat earlier than Cavendish and Mons Mari, or they require a slightly longer period to reach n equivalent stage of maturity.

Under north Queensland conditions, growth is more rapid and the crop may be planted at almost ny time of the year. In commercial practice, owever, planting takes place between April and ugust.

lanting Methods

Before marking out the plant positions, provision must be made for access roads and the moval of the fruit from the plantation. If the rea is steep and broken, a wiring system may be e most economical method of conveying the unches to the packing shed with a minimum of handling and bruising. The positions selected for the loading platforms should be so situated that the distance which bunches have to be carried by hand is reduced to a minimum and that, as far as possible, they can be carried downhill.

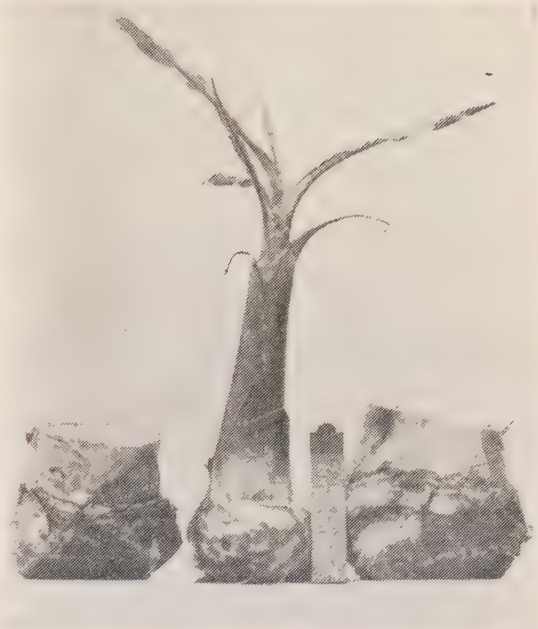


Plate 6

Types of Planting Material. Left—bit: which is a section of a corm trimmed to a single eye; middle—sucker: the most readily available type of planting material; and right—corm: now seldom used in commercial plantations.

The planting positions in the area should be marked out with a stick cut to the required distance between plants. Planting distances vary somewhat with the variety, but those in general use in Queensland are:

Spacing (Feet)	Plants per Acre	Spacing (Feet)	Plants per Acre
9 x 9	535	13 x 13	260
10 x 10	435	14 x 14	220
11 x 11	330	15 x 15	190
12 x 12	300	16 x 16	170

The above figures are applicable to the square system of planting. As a general rule, the number of plants required for a block planted on the contour will be slightly less. In high rainfall areas and in irrigated plantations, plant spacings in the row may be reduced to 6 ft.

In contour planting the procedure is to plant systematically along the contour lines, using the measuring stick to determine the position of each hole relative to the next.

When square planting is to be practised, a reasonably straight line is run across one side of the area, and another on the opposite side as nearly as possible parallel to the first. Using the measuring stick, "sighter" stakes about 7 ft. long are put in at the required intervals along both these base lines. A hole is dug at the first stake position on the base line. The measuring stick is laid with its end in the centre of this hole and in a direct line with the first "sighter" stake at the other side of the block; the second hole is then dug at its other end. This procedure is repeated when the planter turns and comes back along the row defined by the second pair of stakes, and so on. If the area to be planted is too large for easy sighting from one base line to the other, intermediate stakes are placed along each planting row at intervals of about 5 chains.

The planting holes should be at least 18 in square by 15 in. deep, the soil being drawn into a small mound on the lower side. When planting on sloping ground, a small amount of surface soil is first broken into the hole from the upper side. The sucker or bit is then placed in position and sufficient soil is dug from the top and side banks to cover the plant to a depth of about 4 in. This soil is tramped down firmly. More loose soil is then added so that a sucker finally has about 6 in. of soil above the junction of pseudostem and corm, and a bit has the eye buried at a similar depth. When the work is completed, the plant will be in a shallow basin of loose soil with a mound on the lower side.

On hillsides, suckers are planted with the cut surface facing downhill and bits with the eye facing uphill at an angle to the slope. By this means, the follower for the ratoon crop can be set on the uphill side of the parent where it penetrates deeply into the soil and give added firmness to the stool.

(*To be continued*)

Plate 7

Contour Planted Bananas. Plantations are frequently established on the contour with inter-row drains as a precaution against loss of soil from erosion.

KEEPING METALS BRIGHT

Those who have any of the lovely brass, pewter, copper or chromium household articles now so popular will be eager to keep them bright and gleaming.

The care and cleaning of some of these metals s given:

Pewter.—Do not use metal polish for cleaning pewter.

Mix a little non-gritty whiting with some sweet oil (olive, peanut, salad) and rub on with a soft, clean cloth.

Use a soft dry cloth to polish and follow by buffing with a chamois leather.

Brass and Copper.—Apply a reputable brand of polish with a soft, dry cloth and leave to dry. Rub with a soft, dry cloth.

Use a toothbrush to apply the polish to ornamental brass and polish with a soft, clean shoe brush kept for the purpose.

To preserve the polish and to protect brass and copper from early discoloration, give a coat of ransparent lacquer (according to the maker's nstructions), or a light application of liquid urniture wax polish. Allow to dry and buff with soft cloth.

Discoloration which will not respond to the sual treatment may be removed with a solution f salt and vinegar or lemon juice. Dissolve the alt in the liquid to prevent scratching. Wash in ot, soapy water, rinse, dry thoroughly and then olish.

For severe discoloration spirits of salts is ecommended. Use 1 part acid to 5 parts of vater and take care to keep hands out of the ixture. Use a mop, or a rag tied to a stick, apply the solution.

Rinse the article under a tap, wash it in hot, oapy water, rinse, dry and polish. Use an old asin from the cleaning cupboard, and dispose f left-over cleaning fluid immediately.

Wrought Iron.—An occasional polish with a quid silicone furniture polish is the routine ethod for general care of wrought iron. Steel ool dipped in paraffin will remove rust.

Chromium.—This metal usually requires only rub with a soft duster after being washed in ot, soapy water, rinsed and dried.

If a polishing agent is desired, be sure to use ne made specially for chromium—not for other etals.

A light application of furniture cream will give protection.

INEXPENSIVE READY-MADES CAN BE ATTRACTIVE

No matter how much we like dressmaking or how good a needlewoman we may be, there are occasions when a ready-made will pay dividends.

Apart from the time saved there is the pleasure of wearing something you've not made, which is rather like eating a meal you've not cooked.

Many inexpensive ready-mades can be considerably improved and made into more attractive garments with a little planning and work.

Sometimes all that is necessary is to replace plastic buttons and a cheap belt with better quality items.

Frequently a change from contrasting to matching buttons works wonders.

The removal of fussy bows, cheap lace, and artificial flowers can do much to up-grade a garment.

Lack of seam finish and inexpert pressing is occasionally the reason for a lower price—and an hour or two with needle and thread and the steam iron can make up this lack.

Hand stitching a machine stitched hem will certainly do much for the garment.

Faults which cannot be remedied, or are too difficult to remedy, include:

Unmatched plaids or checks.

Off grain cut and construction.

Too tight armhole.

Short waisted bodice.

Bodice which is too long from the shoulder to the bottom of the armhole.

Ill fitting collared neckline.

FILLING FOR CUSHIONS

Bright cushions are a popular method of introducing colour to our surroundings but it is desirable they be as good to use as to look at.

Much of this will depend on the filling used, and today there is a variety of filling material from which to choose.

For those wanting to know something of these fillings, the following information is given:

It is well to remember that the comfort of a cushion rests on the quantity, as much as on the type, of filling used.

A cushion which is packed too tightly has only a limited use, and one which is too loose is unattractive because it cannot hold its shape.

Decide whether the cushion is to be for use and ornament, or ornament only, remembering that both needs can be met in the one cushion.

Foam rubber or plastic is available in a variety of types, some softer than others; it may be in one piece, chopped, or crumbled.

The crumbled type tends to disintegrate with use and needs to be covered with a smooth foam-type material. This prevents the granular feel and appearance caused by the pieces.

Down or duck feathers make a cosy cushion which will last well.

Kapok will compress in time but is cheaper than down or duck feathers.

KEEPING THE NEW LOOK ON HOUSEHOLD EQUIPMENT

Fortunately for today's busy homemakers the new finishes which add brightness and colour to kitchen, laundry and bathroom equipment are easy to care for, and so save time and labour.

Nevertheless it is wise to read the cleaning recommendations in the instruction booklet or tag of new equipment.

You should also check on the labels of new cleaners to find out which surfaces they are suitable for, and how to use them.

The following methods of cleaning some of the newer finishes and materials are given:

Always follow the manufacturer's directions for defrosting and cleaning the interior of a refrigerator.

Mop up spilled liquids immediately.

The plastic fittings on the inside of the door tend sometimes to acquire a smeary look.

To restore the shine, use liquid soapless detergent, undiluted, then rinse and wipe dry with a clean cloth.

The outside surface will respond to an occasional sparing application of a good furnitur cream. (Check the label and follow instructions.)

The old advice to wipe over the oven with a damp cloth while it is warm holds good, as all ovens are still lined with vitreous enamel.

If the oven has become greasy, use a mild abrasive paste containing a grease solvent.

A caustic preparation is useful if the surface is more heavily soiled, but be sure to protect your skin.

For more drastic cleaning use a caustic preparation on a special applicator and leave for a few hours. Be sure to follow instructions.

Stainless steel sinks usually need only be cleaned with hot water, soapless detergent, and a stiff brush.

A paste cleanser will remove stubborn marks.

A sink mat helps to protect the sink.

In order to preserve the finish, polish with meta polish.

—N.S.W. Department of Agriculture's "Press Notes."

Costing of Farm Machinery

By C. G. WRAGGE, Agricultural Engineer.

With tractors as the main source of power on farms, the cost of operating farm machinery is becoming increasingly important as a production cost item. In this article, methods are described which enable tractor and implement costs to be computed. In a later article an attempt will be made to find the solution to such problems as the economics of private ownership versus machine hiring, and the operation of one or more units of a specific machine, or even of different ypes, by the drawing-up of "complete" or "partial" budgets. These budgets enable a farmer to predict fairly accurately which alternative is superior and by how much.

In computing operating costs, various factors
ust be taken into consideration. For example,
e operating cost of some auxiliary equipment
an hourly basis exceeds that of the power
it. But, if computed on a per acre basis, the
st will appear more favourable when con-
lered in the light of performance rates made
ssible by tractor operation. *Per-acre or per-
ur cost of machinery declines rapidly with
reasing use and then declines only moderately
th still more use.* And since the operating cost
auxiliary equipment constitutes an increasingly
ge part of total production costs, it follows
it the operation of equipment at full rather
in below capacity offers a fertile field for the
ainment of increased efficiency and lowered
sts.

In computing costs, the cost per unit of use
each machine is derived from surveys made
d is based on actual, estimated, or selected
ues. Factors included in the estimated values
ich influence costs are total hours of use,
preciation, interest, housing, repairs, labour,
l and miscellaneous items such as oil, grease,
shing and other materials. To obtain more
cise estimates, all factors including prices,
es and assumptions, should be adjusted to
nform with local conditions of machine opera-
n.

Information Required

Before machine cost prediction can be made, it is necessary to have information relating to the following factors which may be grouped under two headings:

(1) *Factors related to machine ownership*—

Fixed Costs

- Original cost
- Service life (depreciation)
- Interest on the investment
- Miscellaneous items: insurance, taxes, shelter

(2) *Factors related to machine operation*—

Variable Costs

- Fuel, oil, and lubrication
- Repairs
- Labour
- Number of days or hours used per year

Additional information that should also be known relates to contractors' rates ruling in the district and any other factors that may modify a decision based solely on costs.

TABLE 1

Suggested Values for Computing Machinery Costs

Machine (1)	Size (2)	Years Until Obsolete (3)	Hours to Wear Out (4)	Annual Repair Cost in % of New Cost (5)	Average Annual Use	
					Units	Hours
Ploughs						
Mouldboard—2 Furrow	10″–12″	15	2,000	7·0	40 acres	80
Mouldboard—3 Furrow	10″–12″	15	2,000	7·0	60 acres	85
Mouldboard—4 Furrow	10″–12″	15	2,000	7·0	80 acres	90
Disc 26″—2 Furrow	8″–10″	15	2,000	7·0	20 acres	40
Disc 26″—3 Furrow	8″–10″	15	2,000	7·0	60 acres	75
Disc—One Way	5″– 6″	15	2,000	5·0	60 acres	40
Disc—One Way	8′–10′	15	2,000	5·0	80 acres	40
Disc—One Way (Seeder)	8′–10′	15	2,000	5·0	80 acres	40
Harrows						
Disc Tandem	7′– 8′	15	2,000	3·0	80 acres	45
Disc Tandem	10′	15	2,000	3·0	100 acres	45
Disc Offset	6′	15	2,000	3·0	60 acres	50
Spike Tooth—4 Section	13′	20	2,500	3·0	60 acres	25
Spike Tooth—6 Section	20′	20	2,500	3·0	100 acres	20
Cultivators						
Row Crop	1 Row	12	2,500	3·5	40 acres	35
Row Crop	2 Row	12	2,500	3·5	80 acres	50
Field Cultivator—Rigid Tine	7′	12	2,500	3·5	80 acres	40
Field Cultivator—Rigid Tine	10′–12′	12	2,500	3·5	80 acres	32
Rotary Hoe	4′–4′ 6″	12	2,500	3·5	60 acres	40
Potato Hiller	2 Row	12	2,500	3·5	40 acres	45
Weeders						
Spring Tine	12′	12	2,500	3·5	40 acres	25
Rod	9′	12	2,500	3·5	40 acres	20
Rollers						
Roller	9′	25	1,500	1·0	60 acres	30
Culti-packer	8′	25	1,500	1·0	130 acres	60
Seeding and Planting Machinery						
Grain drill trailed, combine type	12–24 runs	20	1,200	1·5	40–200 acres	20–50
Corn planter, trailed or tractor mounted with Fertilizer attachment	2 Row	20	1,200	2·0	40 acres	35
Potato planter, trailed or tractor mounted with Fertilizer attachment	2 Row	20	1,200	2·0	40 acres	40
Harvesting						
Grain—						
Harvester, trailed, p.t.o. or engine-functioned	5′– 6′	10	2,000	3·0	200–225 acres	150
Harvester, trailed, p.t.o. or engine-functioned	8′–12′	10	2,000	3·0	330–500 acres	165
Harvester, self-propelled	12′–18′	10	2,000	3·0	600–900 acres	200
Hay—						
Elevator, bale, engine-functioned	..	15	1,500	3·0	100 tons	20
Field forage harvester, p.t.o.	..	12	2,000	5·0	..	60
Forage blower, p.t.o.	..	12	2,500	2·5	..	60
Hay loader	..	10	1,200	1·5	60 tons	30
Mower, p.t.o., tractor mounted	5′	12	2,000	3·5	60 acres	60
Mower, p.t.o., tractor mounted	6′– 7′	12	2,000	3·5	100 acres	50
Pickup baler, p.t.o.	..	12	3,000	3·0	200 tons	80
Pickup baler, engine-functioned	..	12	3,000	3·0	400 tons	115
Rake, side-delivery	9′– 6″	15	1,500	2·0	50 acres	20
Rake, dump, horse drawn	9′–10′	10	1,500	4·0	40 acres	20
Rake, buck, tractor mounted	6′– 7′	12	1,500	2·0	40 acres	20
Maize—						
Maize picker, p.t.o.	1 Row	10	1,500	3·0	100 acres	200
Maize picker, p.t.o.	2 Row	10	1,500	3·0	200 acres	220
Cotton—						
Spindle cotton picker	1 Row	10	2,000	3·0	300 acres	500

TABLE 1—*continued*

SUGGESTED VALUES FOR COMPUTING MACHINERY COSTS—*continued*

Machine (1)	Size (2)	Years Until Obsolete (3)	Hours to Wear Out (4)	Annual Repair Cost in % of New Cost (5)	Average Annual Use	
					Units	Hours
iscellaneous—						
Distributor, Fertilizer	8′	10	1,500	3·0	40 acres	20
Feed grinding mill, plate type	6″ (8–30 bu/hour depending on fineness)	15	2,000	3·0	8–30 tons	40
Feed grinding, mill, hammer	10″	15	2,000	3·0	30 tons	20
Farmyard Manure Spreader, p.t.o.	2 tons	10	2,000	3·0	200 tons	100
Sprayer, field	..	10	2,000	5·0	4,000 gal.	50
Tractor	..	10	8,000	3·5	200 tons	800
Trailer	..	10	5,000	1·5	800 hours	800

The factors of machinery costs related to achine ownership include costs that remain pproximately constant regardless of the annual e of the machine and are therefore termed XED COSTS. Depreciation, of course, does pend somewhat on the amount of use. It could so be shown that life expectancy of a machine dependent largely on the care and maintenance receives. Since the service life and, therefore, e depreciation, cannot logically be listed as an erating cost, it is usually included as one of the st factors related to machine ownership.

Machinery costs related to machine operation clude costs incurred in actually operating the achine. Costs of fuel, oil, lubrication, and bour are practically uniform for each unit of e. The cost of repairs is always difficult to aluate because so many variants are involved. ne number of days a machine is used a year fluences the cost per unit of work done. Since e costs of owning a machine are relatively ible and are incurred whether the machine is ed or not, it is fairly obvious that increasing e number of days' use per year has the effect decreasing the total cost of using the machinery r unit of work done.

) Factors Related to Machine Ownership—Fixed Costs

Original Cost.—Actual prices should be used henever they can be obtained. The original st of a machine must be known before machine st prediction can be made.

Service Life—Depreciation.—The total service life of a machine must be estimated to determine the annual charge of depreciation. It is not possible to wait until a machine is worn out in order to predict how long it will last. The service life of a machine will obviously vary, seeing that it is governed by the amount and nature of use and the care and maintenance given. There are no standards or average machinery life expectancies universally recognised as being applicable to all farms. So each owner must rely on his own judgment in estimating the total expected life of a machine. The suggested values given in Table 1 have been based on surveys made and can be used as a guide in estimating service life. It should be noted that some of the values suggested which relate to annual usage are based on average annual use and not necessarily on the calculated effective capacities of the machines assuming a 17½ per cent. time loss. For example, the effective capacity of a 3–12 in. furrow, 3-point- linkage mouldboard plough operated in average soil at 3 m.p.h. assuming a 17½ per cent. time loss would be calculated as having an effective capacity equivalent to $\frac{1}{10} \times \frac{3 \times 12}{12} \times \frac{3}{1} = 0\cdot 9$ acres an hour and not 0·71 acres an hour as calculated from Table 1 when annual usage is 60 acres or 85 hours.

Depreciation.—Depreciation is defined as the loss in value and service capacity resulting from natural wear in use and obsolescence and can be treated as both a fixed and variable cost. A truly fixed depreciation cost can result from rust, decay or changes in farm techniques which make the machine unsuitable for the new techniques adopted, and loss in value as new models appear. These should be treated as "time-depreciation" costs. "Wear-depreciation" costs obviously vary with use. In calculating depreciation, however, it is usual to disregard this differentiation and regard all factors affecting depreciation as a whole. It is necessary to know the amount of depreciation in making cost predictions and also in determining trade-in or resale values.

A machine naturally wears out with use, but the rate of wear will be governed by such factors as the skill of the operator, operating conditions, routine maintenance, and the quality or design of the machine itself.

Obsolescence is one of the important factors affecting depreciation and perhaps one of the most difficult to foresee and thus evaluate. Maize attachments for all-crop harvesters and haymaking attachments for flail forage harvesters are examples of machinery developments which increase the versatility of some machines and in so doing tend to make other equipment obsolete before its estimated life expectancy. In view of this it is difficult to predict when a machine offering superior performance or reduced costs is likely to be developed that could make other machines obsolete in a relatively short time.

Method of Estimating Depreciation.—Once the expected service life of a machine has been determined, the most common and simplest method of calculating depreciation is by the straight-line method. By this method the value of the machine is reduced by an equal amount each year during its useful life, that is, *the annual depreciation is equal to the original cost divided by the total estimated life of the machine.*

For many purposes this method of determining annual depreciation will give a satisfactory result, but since machines have some salvage value at the end of their service lives, it is usual to make some allowance for a trade-in value. This value, in some cases, can be an appreciable amount, particularly if the equipment is of the more expensive type.

In computing costs, it is generally assumed tha 10 per cent. of the original cost is a reasonabl figure to allow for a trade-in value of the machin at the end of its service life.

Interest on the Investment.—When capital o money is used to purchase machinery, an amoun termed "interest" should be allowed since th money cannot be used for other purposes, suc as the purchase of land, livestock, bonds o other dividend—or interest—earning enterprises

The investment in a machine becomes less a a machine grows older because part of the investment has been used and written off as depreciation. In view of this, it is more convenient t calculate interest charges by an equal amount eac year of the machinery's life. This can be calculated when the straight line method of depreciation is used by finding the average investment i the machine over its full life. *It is equal to one half the sum of the original cost and the trade-i value.* As an example, a machine originall priced at £1,000 with a trade-in value of 10 pe cent. of its initial cost or £100 would have a average investment of $\frac{1000 + 100}{2} = £550$ The annual interest on the investment at 5 pe cent. would be £550 × 5/100 = £27 10s. I calculating interest, it must be based on curre bank rates of interest on loans. The interest ra of 5 per cent. given in the example is somewh low as compared with present rates and was onl used for convenience in explaining the calculation stated.

Insurance.—Cost of insuring farm machiner against loss by fire, wind-storm, floods, and accident liability is justifiable because a farme carries the risk if he does not insure.

Insurance should be calculated on the sam basis as interest, that is, on the average value o the machine for the whole period of its us rather than for a single year. An accepted figur for an annual charge is 0·4 per cent. of th original cost.

Shelter.—It is reasonable to assume that she tered machines probably last longer than unshe tered ones; hence, a charge for shelter should b made or higher depreciation used. As a rule-o thumb, an annual charge of 1 per cent. of th original cost is considered a reasonable figur For costly machines, such as self-propelled al crop harvesters and cotton pickers, a somewh smaller percentage may be charged.

(2) Factors Related to Machine Operation—Variable Costs

These are direct operating costs incurred in he operation of farm machinery. For example, uel and oil are major operating expenses of farm nachinery and more so where some units are ngine-functioned. The cost of fuel and oil over he life of a tractor usually is more than the nitial cost of the tractor.

Since all machine operations require power, t is necessary to know fuel and oil consumption o compute cost of operation. As such costs ary directly with the extent of use, they are lassified as VARIABLE COSTS and include:

Direct labour; indirect labour; direct materials; indirect materials; lost time; repairs; lubrication.

Direct Labour.—An important cost of using arm machinery is the labour required to operate . The wages, salaries and allowances of the perator (or operators) engaged on the actual peration of the tractor, or tractor and auxiliary quipment, must be computed as a direct labour ost.

Indirect Labour.—Occasions may arise where upervision of operators and equipment is neces- ary. In such cases, the cost of supervision should e added to the particular cost of the operations s the supervisor could have been gainfully mployed elsewhere. The wages, salaries and llowances of such supervisors, however, are costs nore likely to affect agricultural contractors and astoral organizations than the average farmer. s supervision cost would be directly propor- oned to direct labour cost, a reasonable figure to ke would be 25 per cent. of the direct labour ost.

Direct Materials.—As mentioned earlier, fuel nd oil are major operational cost items of trac- rs and engine-functioned machinery. Since the nsumption of fuel and oil will be governed by ich factors as size and type of engine, the type fuel burned and the work being performed, e cost of fuel and oil must be computed for ch individual machine.

In computing such costs, an almost essential ljunct to machinery costing is a log book in hich a daily record should be kept of the follow- g items: Consumption of fuel, oil and grease; urs worked; area cultivated and type of work performed. Records of the costs of fuel, oil, repairs and the dates when costs were incurred, should also be kept in the log book.

Indirect Materials.—Cost of materials such as flushing oil, cleaning rags, grease, washing materials and rust inhibitors for the upkeep of tractors and equipment, baler twine or wire, sprays and similar supplies must be computed when work is self-performed, but may (or may not) be included in charges made by contractors.

As a rough guide the cost of indirect materials can be computed as being 10 per cent. of all direct materials costs.

Lost Time.—The percentage of time lost is the most difficult to evaluate as it has to cover factors such as:

(i) Lubrication and refuelling
(ii) Machine adjustment
(iii) Replenishing seed and fertilizer hoppers
(iv) Unloading harvested products
(v) Idle travelling, such as travelling to fields, turning on headlands
(vi) Clogging
(vii) Breakdowns

As loss of time directly affects the direct labour and direct materials costs, it is a cost item which cannot be disregarded. In computing costs, it should not exceed 20 per cent. of the sum of these two costs. As it is related to the capacity of field machines, a simple formula for working out the effective capacity of field machines assuming 17½ per cent. lost time is as follows:

$$\text{EFFECTIVE CAPACITY (acres per hour)} = \tfrac{1}{10}\ (\text{WIDTH OF MACHINE IN FEET} \times \text{SPEED m.p.h.})$$

The accompanying chart (Plate 1) originally devised by E. G. McKibben makes it possible to read the resultant capacity for any normal width, speed, and percentage of lost time without making calculations.

Repairs.—Repair costs are difficult to estimate because amount of use, nature of use, and the maintenance and care given the machine influence repair needs. Repair costs usually include both the material and labour required to make the repairs.

Some investigators express annual repair costs as a certain percentage of the initial cost of the machine. This method has been adopted in the suggested values given in Table 1. An alternative

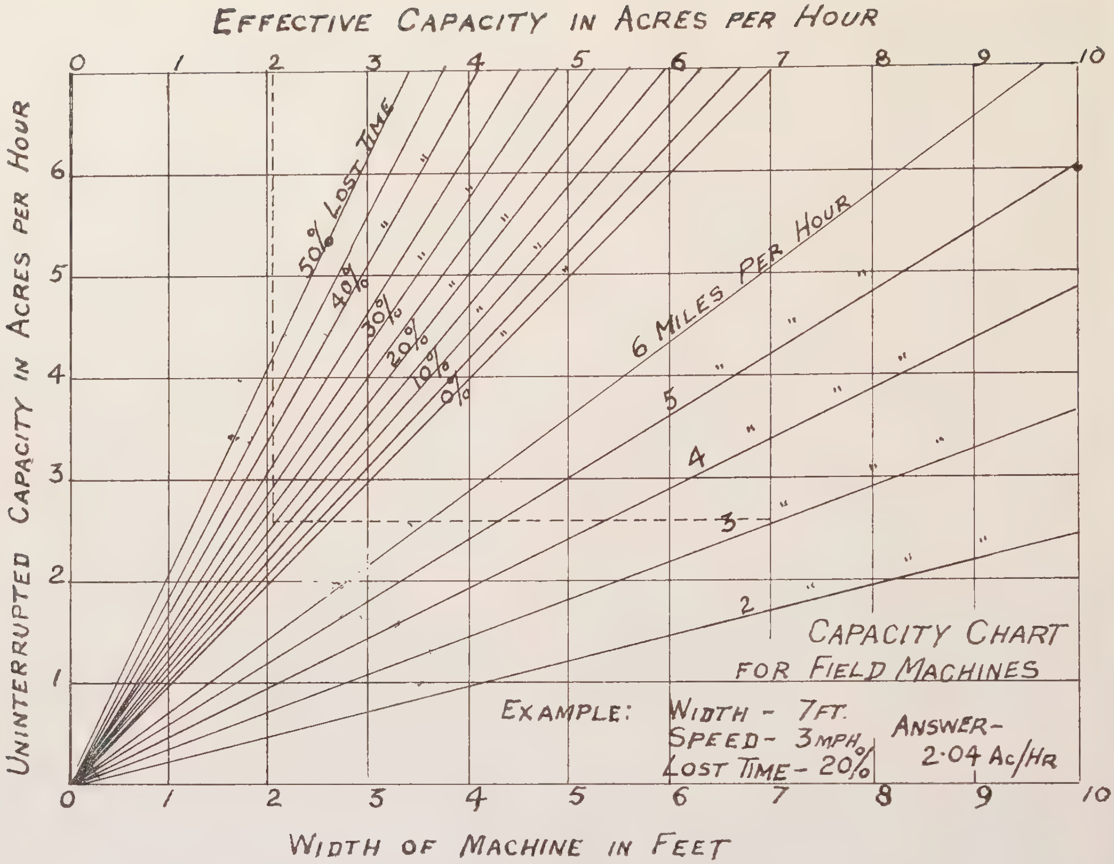


Plate 1

method is to express repair costs for the entire life of the machine as a percentage of the initial cost. As an example, a suggested charge of 35 per cent. of the original cost for a tractor with a life expectancy of 8,000 hours would give the same total repair cost as the 3·5 per cent. annual charge suggested in Table 1, if the tractor were used for 800 hours a year for 10 years.

In the case of tillage implements, the costs of sharpening and replacing shares and other soil-working units are included in the values suggested. In surveys undertaken the repair costs were, generally speaking, somewhat lower than those stated in Table 1, but the higher values given allow a margin large enough to cover keeping the machine in good repair, transportation and a man's time to obtain the parts, and pay a wage to the mechanic or farmer doing the work. These last two items are often overlooked or disregarded in estimating these costs.

Lubrication.—The labour required to lubricate a machine is usually more expensive than the cost of the lubricant.

The total annual cost of lubrication, including labour for lubricating a complicated machine such as a self-propelled all-crop harvester, may be as much as 1 per cent. of the original cost of the machine. This incidentally would include crank-case oil. For simple machines, such as ploughs, cultivators and other field implements, the cost of lubrication would be much less. A nominal 0·4 per cent. of the original cost of the machine is suggested for all field machines. For machines used less than 100 hours annually and for the more expensive machines, an annual charge of 0·2 per cent. of the original cost is more realistic.

From these figures it will readily be seen that the hourly cost of an implement can be reduced appreciably by increasing the annual usage of the implement.

EXAMPLE 1

CALCULATING TRACTOR COSTS PER HOUR

Assume a new price of £1,348 and a life of 8,000 hours or 10 years with a trade-in value of 10 per cent. of new price and terest on investment at 5 per cent. per annum.

FIXED COSTS (HOURLY COST OF OWNERSHIP)

	£	s.	d.
epreciation $= \frac{\text{Original cost—Trade-in Value}}{\text{Life}} = \frac{\text{£1,348—£134 16s.}}{8,000} = \frac{\text{£1,213 4s.}}{8,000}$	0	3	0·40
terest at 5% on Half the sum of Original cost and Trade in value $= \frac{\text{£1,348 + £134 16s.}}{2} \times \frac{5}{100} \times \frac{240}{800}$	0	0	11·12
surance at 0·4% on Half the sum of Original cost and Trade-in value $= \frac{\text{£1,348 + £134 16s.}}{2} \times \frac{4}{1,000} \times \frac{240}{800}$	0	0	0·89
elter at 1% on Original cost $= \frac{\text{£1,348}}{1} \times \frac{1}{100} \times \frac{240}{800}$	0	0	4·04
Total Fixed Cost	£0	4	4·45

VARIABLE COSTS (HOURLY COST OF OPERATION)

Direct Materials

	£	s.	d.
el—1 gal. dieselene per hr. @ 3/0½ per gal.	0	3	0·50
ankcase oil—2 gal. every 200 hr. @ 9/7½ per gal.	0	0	1·15
ankcase oil—$^1/_{20}$ gal. @ 9/7½ per gal. for topping up every 10 hr.	0	0	0·58
ansmission oil—gearbox and final drive 108 pt. @ 11/1½ per gal. every 800 hr.	0	0	2·25
ansmission oil—$^1/_{16}$ gal. @ 11/1½ per gal. for topping up every 60 hr.	0	0	0·14
r cleaner oil—1 pt. every 10 hr. @ 1/3 per pt.	0	0	1·50
ement fuel filter replacement every 400 hr. @ 28/4	0	0	0·85
ement oil filter replacement every 200 hr. @ 16/4	0	0	0·98
brication at 1% of the Original cost $= \frac{\text{£1,348}}{1} \times \frac{1}{100} \times \frac{240}{800}$	0	0	4·04
Total Direct Materials Cost	£0	3	11·99

	£	s.	d.
direct materials at 10% of Direct materials $= \frac{10}{100} \times$ 11·99	0	0	4·80
pairs at 3·5% of Original cost $= \frac{\text{£1,348}}{1} \times \frac{3\cdot5}{100} \times \frac{240}{800}$	0	1	2·15
rect labour. Operator's wages and keep 8/– per hr.	0	8	0
st Time at 17·5% Direct materials + Direct Labour Costs $= \frac{17\cdot5}{100} \times (3/11\cdot99 + 8/–) = \frac{17\cdot5}{100} \times 11/11\cdot99$	0	2	1·20
Total Variable Costs	£0	15	8·14
tal hourly cost = Total hourly Ownership cost + Total hourly Operation cost = £0 4s. 4·45 + £0 15s. 8·14d.	£1	0	0·99

st per 8-hr. day = £1 0s. 0·99d. x 8 = £8 0s. 7·92d.

EXAMPLE 2

CALCULATING COST OF PLOUGHING WITH A MEDIUM TRACTOR AND A 3–POINT LINKAGE, 3-FURROW, 12″ MOULDBOARD PLOUGH

Item	Tractor	Plough
Initial cost	£1,150 0s. 0d.	£140 0s. 0d.
Annual use	800 hours	85 hours 60 acres
Estimated life	8,000 hours	2,000 hours

Item	Tractor £	s.	d.	Plough £	s.	d.
Annual cost of ownership : (FIXED COSTS)						
Depreciation $= \frac{\text{Initial cost—Trade-in value}}{\text{Life}}$	0	2	7·05	0	1	3·12
Interest on Investment at 5% $= \frac{\text{Initial cost + Trade-in Value}}{2} \times \frac{5}{100}$	31	12	6	3	17	0
Insurance at 0·4% $= \frac{\text{Initial cost + Trade-in Value}}{2} \times \frac{4}{1{,}000}$	2	10	7·2	0	6	1·92
Shelter at 1% on Initial cost	11	10	0	1	8	0
Total Cost of Ownership	£45	15	8·25	5	12	5·04
Direct Materials						
Annual cost of operation : (VARIABLE COSTS)—						
Fuel—1 gal. dieselene per hr. @ 3/0½ per gal.	121	13	4	..		
Crankcase oil—2 gal. every 200 hr. @ 9/7½ per gal.	3	17	0	..		
Crankcase oil—$1/_{20}$ gal. @ 9/7½ per gal. for topping up every 10 hr.	1	18	6	..		
Transmission oil—gearbox and final drive 108 pt. @ 11/1½ per gal. every 800 hr.	7	10	2·25	..		
Transmission oil—$^1/_{16}$ gal. @ 11/1½ per gal. for topping up every 60 hr.	0	9	3·25	..		
Air Cleaner oil—1 pt. every 10 hr. @ 1/3 per pt.	5	0	0	..		
Element fuel filter replacement every 400 hr. @ 28/4	2	16	8	..		
Element oil filter replacement every 200 hr. @ 16/4	3	5	4	..		
Lubrication at 1% and 0·4% on Initial cost of tractor and plough respectively	11	10	0	0	11	2·40
Total Direct Material Costs	£158	0	3·5	0	11	2·40
Indirect Materials at 10% of Direct Materials cost	15	16	0·35	0	1	1·44
Repairs and Maintenance at 3·5% of Initial cost of tractor and 7·0% of Initial cost of plough	40	5	0	9	16	0
Direct labour—operator's wages and keep for 800 hr. @ 8/– per hr.	320	0	0	..		
Lost time at 17½% of Direct Materials + Direct Labour	83	13	1·83	..		
Total Annual Cost of Operation	£617	14	5·68	10	8	3·84
Total annual cost = Total annual ownership cost + total annual operation cost	663	10	1·93	16	0	8·88
Cost per 8-hr. day	6	12	8·40	1	10	2·24
Cost per hr.	0	16	7·05	0	3	9·28

From these figures it will readily be seen that the hourly cost of an implement can be reduced appreciably by increasing the annual usage of the implement.

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Castrating Calves

By G. I. ALEXANDER, Senior Husbandry Officer,

nd M. A. BURNS, Senior Adviser, Cattle Husbandry Branch.

The castration of calves is a commonly perormed operation on a beef cattle property. However, it is one that requires skill and attention o detail. This article discusses the main points f the operation. Methods of restraint of calves or castration are best left to another article, so we will assume in this case that the calf is estrained in a calf cradle.

Castration and branding are usually performed at the same time to avoid double handling of the calves. Animals are done at any time during the first year of life but it is preferable to do them at three to four months of age. Ideally, the younger the animal the better, as castration is then less shock to it and setback to its growth is lessened. Older animals can be castrated but more care is required.

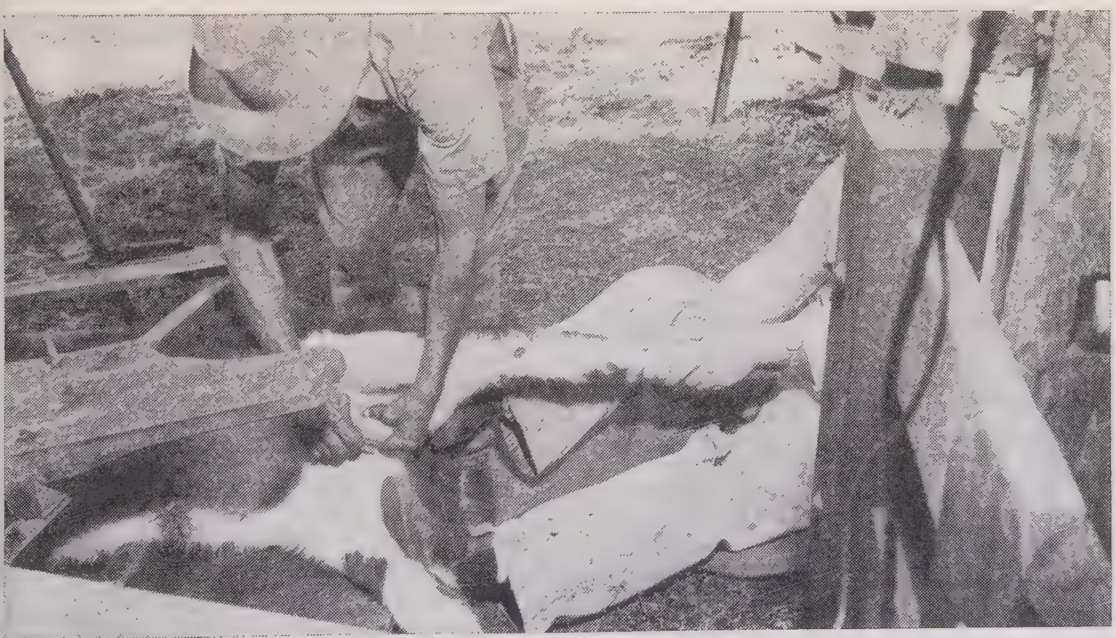


Plate 1

The operator is bending over the calf holding the "purse" with his left hand and preparing to make a cut from the bottom (of the purse) to the lateral side.

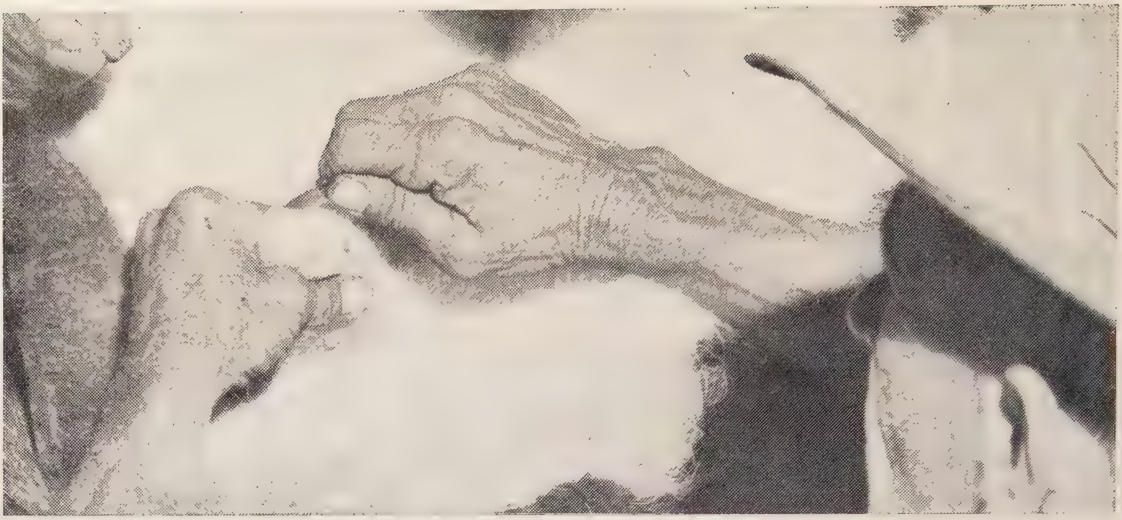


Plate 2

Closer view of the operator holding the purse with knife ready to make the first cut over the lowest part of the purse.

For vealer production, it may be desirable not to castrate at all in order to obtain maximum growth, as uncastrated calves grow faster than castrates and castration always causes some retarding in growth regardless of age.

Equipment

The main equipment required for this operation is a good, sharp knife. A scalpel is very useful as it can be sterilized before use on the day an can be kept for castrating calves only. Ther is always a tendency to use a knife for othe purposes and so get it contaminated and run th risk of introducing infection into the cuts mad For this reason a scalpel is recommended, eith with a fixed blade or with detachable blades.

Detachable blades have the advantage of bein disposable. Should the scalpel blade becom

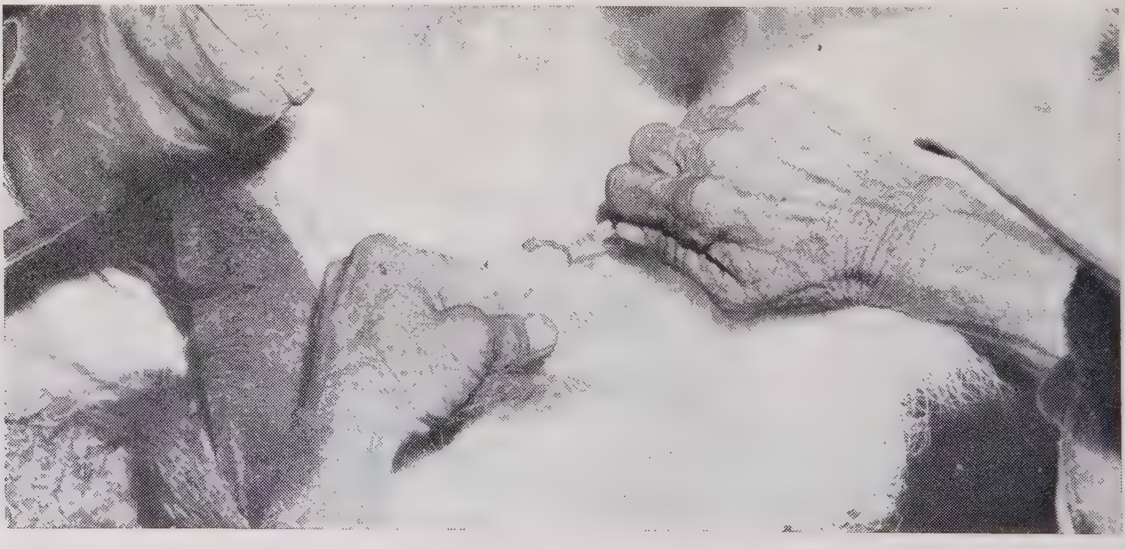


Plate 3

The testis is forced out through the cut by the pressure of the operator's left hand.

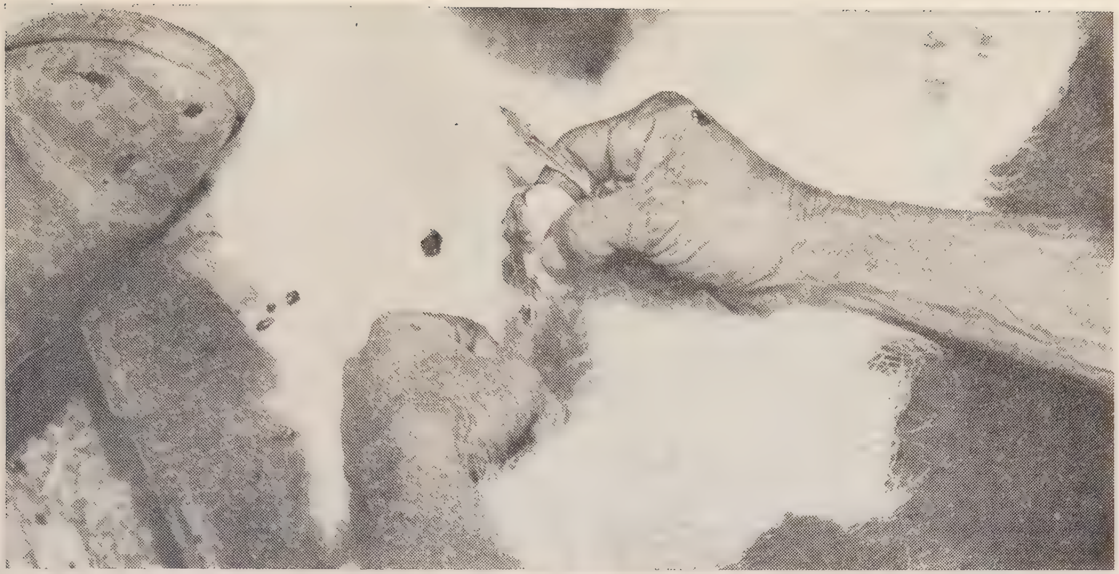


Plate 4

The testis is grasped firmly in the right hand and pulled out from the purse.

blunt, then it has to be sharpened, whereas a blunt detachable blade can be thrown away and replaced with a fresh one. When not in use on castrating days, the scalpel should be kept in a tray of strong disinfectant. When getting ready for castrations it is as well to have a small tray filled with a disinfectant solution in which to keep the scalpel. In addition, a bucket filled with disinfectant solution is convenient for washing the operator's hands before and after castrating. However, it is not a good idea to drop the scalpel into the bucket rather than placing it in a tray

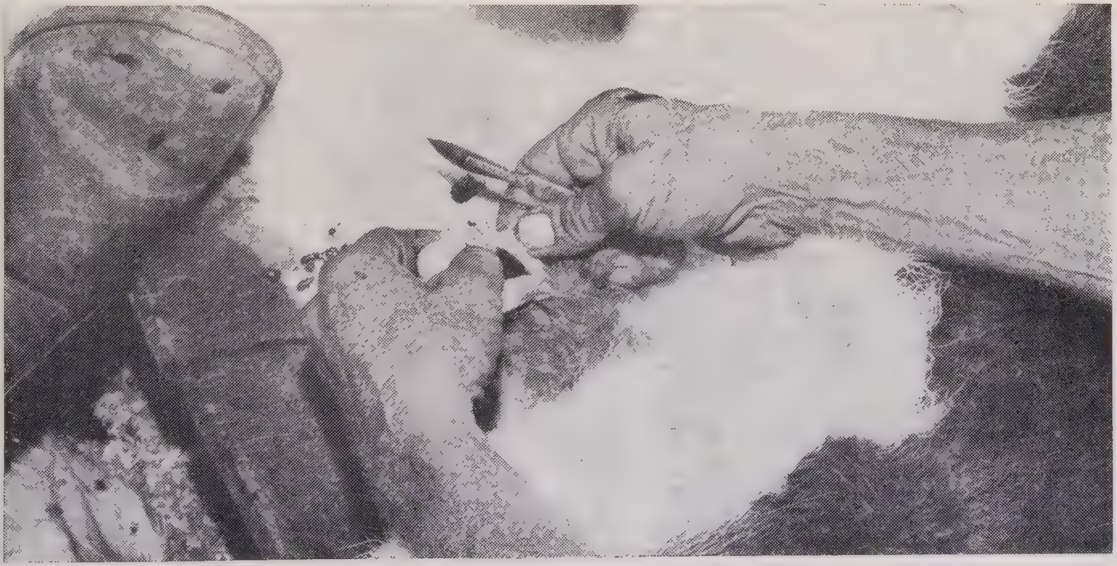


Plate 5

The covering membrane is separated from the testis as shown held in the right hand.

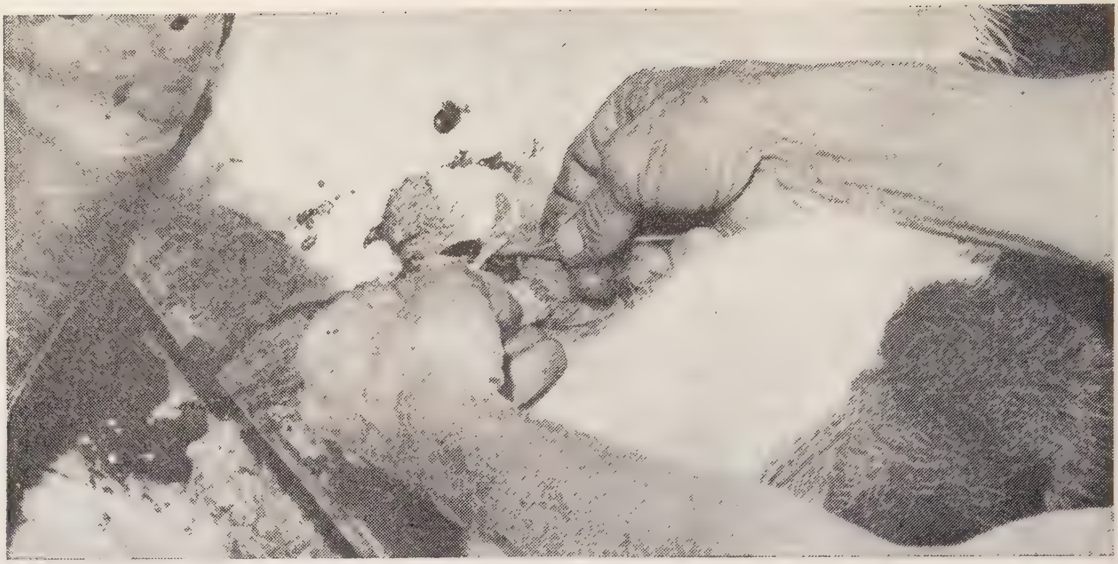


Plate 6

The covering membrane is cut through so that portion is left attached to the lower end of the testis.

as the edge may get turned by hitting the bottom and also there is a risk of cutting one's hand when picking the knife up. A thin layer of cotton wool in the bottom of the tray will be a safeguard against turning the edge of the knife.

The Operation

In considering the actual method of castrating a calf, one could go into a detailed description of the anatomy of the testes and the scrotum or "purse," but we shall merely describe the method

Plate 7

The testis is pulled firmly out so that the cord can be cut some distance from the testis.

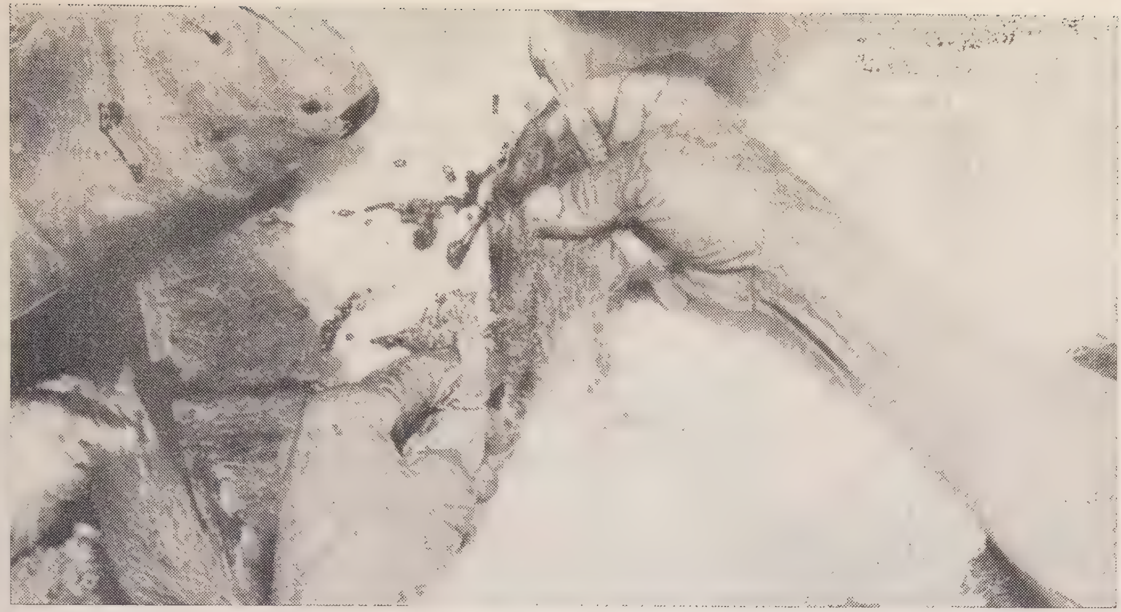


Plate 8*

The purse is pulled out from the body so that the cord can fall back into the canal.

*Photographs by D. McGavin, Senior Histopathologist.

surgery involved with as little resort to technical rms as possible.

The first step to take is to make sure that both stes are down in purse. Be quite sure of this it is preferable not to castrate an animal at all only one testis is accessible. It is a wise move leave any calf with only one testis in the purse til another day in the hope that the second testis ll descend as the calf gets older. When one moves the accessible testis, it becomes a matter guesswork which side of the purse the other e lies in when the calf is caught later to see if e second testis has come down. When one llows the testis along its length and up the rd, one can feel the cord emerging out of a nal which connects the inside of the purse with e cavity of the abdomen. It is down these nals (one on each side) that the testes descend the calf grows. Sometimes it is possible to el the testis lying in the canal and skilful operars can manipulate it down into the purse.

The next step is to take hold of one of the stes firmly between the thumb and forefingers shown in Plate 1. The testis is held firmly that the skin of the purse is tightly stretched over the testis. Also care is taken to push the testis towards the lowest part of the purse in order to prevent it going into the canal, and to allow for good drainage (Plate 2).

Then holding the scalpel short, a firm cut (through the skin) is made of sufficient length to allow the testis to burst through the cut. (It is important that the cut be made through the membrane forming the inside of the purse.) A cut into the substance of the testis is quite in order as the cut is then made sufficiently deeply to allow the testis to be forced through the cut (Plate 3).

Then while still maintaining the pressure forcing the testis out, it is grasped in the right hand (Plate 4).

Next, the testis is separated from the inner lining of the purse which is a whitish membrane (Plate 5).

This membrane is attached to the lower end of the testis and has to be cut away (Plate 6). In order to promote drainage, it is a sound practice to cut some of the membrane off with the testis.

Next, with the left hand, the testis is pulled out from the purse (Plate 7) and the cord cut close to the body where the blood vessels are fewer. The pulling of the testis out from the purse stretches the blood vessels and so when they are cut their inner linings tend to twist, sealing the vessels off and reducing bleeding.

Lastly, the purse is pulled out firmly (Plate 8 so that the cut end of the cord skips up into th canal and so is less likely to become infected.

The operation is then repeated for the secon testis and the calf can be released so that it ca walk away quietly.

* * *

Advice On Buying Fodder Cane Setts

Be on your guard against breaking the quarantine regulations when you're buying fodder cane setts, said Mr. N. J. King, Director of the Bureau of Sugar Experiment Stations. Because quarantine areas have been declared for the purpose of checking the spread of sugar cane diseases, cane cannot be moved freely in all parts of Queensland. Strict rules govern the transfer of cane from one district to another.

He said some serious sugar cane diseases occur in some parts of Queensland and not in others. It is to protect the "clean" areas that the quarantine areas have been established. Fodder cane is just another variety of sugar cane.

Although the regulations on the movement of cane are intended in the first place to help sugar farmers keep their crops free from disease, they also benefit the dairyfarmer. He is able to grow better fodder through having healthy cane. Furthermore, crops like maize and elephant grass which are attacked by some of the same diseases that affect cane are also protected.

Any transfer of either sugar cane or fodde cane from one quarantine district to another mus first be authorised by an inspector under *"Th Sugar Experiment Stations Acts,* 1900 *to* 1959 and a permit issued. But under no circumstance will the transfer of planting material be permitte from southern Queensland to central an northern Queensland. A fine of up to £100 ma be imposed on people breaking these regulations Both seller and buyer are regarded as offenders

Mr. King said advertisements in newspaper offering cane for sale could prove a source o trouble for uninformed farmers.

"Before you buy your planting material" he said, "consult your district Agriculture Department Adviser in Agriculture. If it is more convenient, consult the nearest officer-in-charge o the Sugar Experiment Stations at Bundaberg Mackay, Brandon, or Gordonvale, or the Director of Sugar Experiment Stations, 99 Gregory Terrace, Brisbane."

To Improve Pastures In The Traprock And Granite Soils Of South-East Queensland

By G. R. LEE, Agrostologist.

The traprock and granite soils in south-eastern Queensland cover an area of approximately 4,000 sq. m. between the southern Darling Downs and he Queensland–New South Wales border. This area is included in the Shires of Rosenthal, Stanthorpe, part of Inglewood and part of Glengallan, and is shown in Plate 1.

It is essentially a grazing area although horticultural crops are of importance in some 30 sq. m. of the granite belt, and tobacco growing along he Dumaresq River has provided valuable ncome.

One of the highest points above sea level is at The Summit (3,030 ft.) in the Granite Belt. From there the country falls away to Warwick (1,492 ft.) in the north and Stanthorpe (2,660 ft.) and Wallangarra (2,882 ft.) towards the south. West of Stanthorpe the altitude decreases towards Glen Lyon and the Dumaresq Valley, Texas being at 933 ft. The area in the main is hilly and very steep, some parts being quite rugged. Cultivation in those cases is not possible and consequently greater use has been made of the smaller areas of undulating country and fertile pockets in the vicinity of water courses.

The climate is essentially temperate but sharp fluctuations in temperatures do occur. The rainfall varies from 25 to 30 in. a year, approximately two-thirds falling during the summer months. Much of this comes from storms. High summer temperatures, resulting in high evaporation, seriously reduce the effectiveness of this rain. The spring and autumn are frequently poor rainfall periods.

TABLE 1

AVERAGE DAILY MAXIMUM AND MINIMUM TEMPERATURES

——	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
WARWICK													
Maximum	86·5	84·8	81·5	76·6	69·5	64·4	63·2	66·6	72·8	78·9	83·6	85·8	76·2
Minimum	62·9	62·2	59·2	52·2	44·9	39·9	37·9	38·6	43·9	51·3	57·4	60·5	50·9
STANTHORPE													
Maximum	82·6	80·8	77·2	71·8	65·1	59·5	58·0	61·4	67·6	73·7	78·5	81·2	71·5
Minimum	59·3	58·5	55·5	47·9	40·5	35·7	33·9	34·9	40·4	47·8	53·5	56·7	47·0

TABLE 2

AVERAGE MONTHLY AND ANNUAL RAINFALL (pt.)

WARWICK

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
358	310	260	160	148	170	180	140	175	232	266	350	2,749
STANTHORPE												
368	318	259	170	175	188	200	173	219	250	276	356	2,952
TEXAS												
344	252	216	133	145	186	184	130	150	211	238	305	2,494

Native Vegetation

The native pastures throughout the district are essentially composed of summer growing perennial grasses, the most common of these being:

Pitted Blue Grass ..	*Bothriochloa decipiens*
Blow-away Grasses ..	Species of *Panicum* and *Chloris*
Spear and Wire Grasses	Species of *Stipa* and *Aristida*
Love Grasses	Species of *Eragrostis*

In smaller quantities the following grasses are found:

Queensland Blue Grass	*Dichanthium sericeum*
Wallaby Grass ..	*Danthonia spp*
Kangaroo Grass ..	*Themeda australis*

The associated native legumes, the most common of which is *Glycine tabacina* are poorly represented and consequently are of very limited value for the grazing animal. Three introduced legumes, which are now naturalised are of importance in localised areas. These are Burr medic (*Medicago denticulata*), Woolly Burr Medic (*Medicago minima*) and Cluster Clover (*Trifolium glomeratum*). Burr medic can produce very useful feed and stands of this legume are usually associated with areas of slightly higher soil fertility and favoured areas which benefit from additional moisture.

The Soils

1. *Granite*. There is considerable variation in the soils throughout the granite belt. For the most part they are of a sandy nature, the colour and texture of the surface usually being classified as a light grey sandy clay loam. In the northern part of the district the soils are fine grained, the surface soil about 6 to 9 in. deep overlying a permeable clay subsoil. Coarse grained granitic soils occur in the southern portion of the belt and are of a more skeletal nature. The granite soils vary from slightly acid to strongly acid and the major plant nutrients, particularly phosphorus, are usually in poor supply.

Responses to trace elements have not yet been demonstrated in either annual grazing crops or sown pastures.

The granite soils are usually easily worked but have a strong abrasive action on the cultivation implements.

2. *Traprock*. The traprock soils are derived from slates and shales and for the most part are very stony. They are shallow soils the texture usually varying from a sandy loam to a sandy clay loam. Although the major plant nutrients, nitrogen, phosphorus and potash are usually in poor supply they are generally present in slightly higher quantities than in the granite soils. Cultivation of these soils is possible but the stony nature of the surface is hard on the cultivating implements.

When cultivated, both soil types are vulnerable to erosion, the danger period occurring during the summer months when high intensity storms are frequently experienced. This mainly applies in the sloping country where erosion control measures should be adopted prior to cultivation.

Pasture Improvement

The native pastures are used extensively for grazing and are capable of providing adequate feed during the summer months. During the winter, however, the stock are generally subject to serious nutritional stress resulting in overall loss of weight and poor growth of young stock. Depending on the severity of the winter, stock losses may occur.

During the last 6 years, pasture improvement techniques aimed at providing green feed for

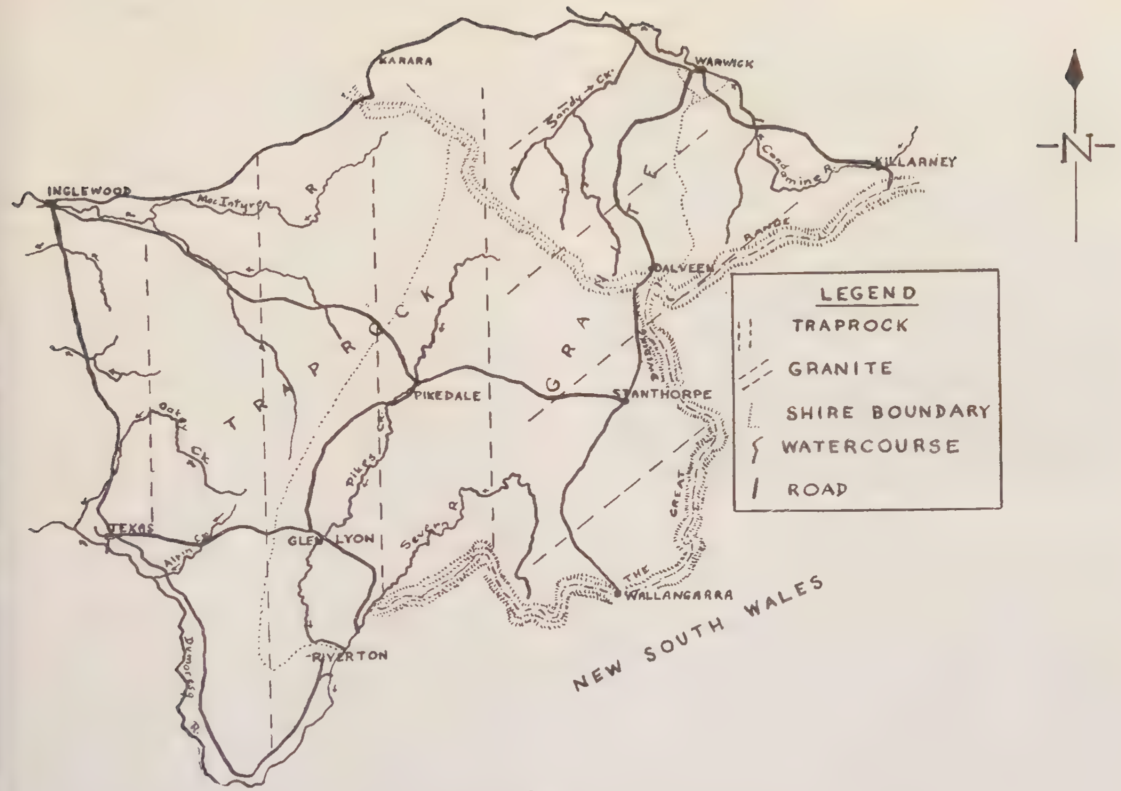

KARARA
WARWICK
KILLARNEY
INGLEWOOD
MacIntyre R.
Sandy Ck
Condamine R.
RANGE
DALVEEN
TRAPROCK
GRANITE
PIKEDALE
STANTHORPE
Oaky Ck
Pikes Ck
Severn R.
TEXAS
GLEN LYON
RIVERTON
Dumaresq R.
GREAT
THE
WALLANGARRA
NEW SOUTH WALES
N
LEGEND
TRAPROCK
GRANITE
SHIRE BOUNDARY
WATERCOURSE
ROAD

Plate 1

The Approximate Extent of Granite and Traprock Soils in South-East Queensland.

azing during the winter months have made a
gnificant contribution towards offsetting the
asonal nutritional deficiency.

Evidence of pasture improvement can be traced
ck as far as the mid 1930's but it was not
til the early 1950's that much headway resulted.
ne encouraging results from pasture improve-
ent in the New England district of northern
w South Wales together with assistance and
vice from Mr. A. Clothier, of A.C.F. and
irleys Fertilizers Ltd., influenced many graziers
southern Queensland to plant improved
stures. From 1952 to 1958, approximately
,000 acres of improved pastures were sown.
iring this period the Department of Agriculture
d Stock was responsible for conducting pre-
ninary investigations into the suitability of
sture species, fertilizer requirements, manage-
nt practices and methods of establishment.
is work is still continuing together with other
vestigations. Information already gained is
oviding a sound basis for district recommenda-
ns regarding pasture improvement methods
d pasture mixtures.

Pasture Establishment

1. *Seed Bed.*—Best results have been gained where care and attention have been given to the preparation of the seed bed. To prepare the ground fully may be an expensive operation depending on the amount of clearing necessary and the number of cultivations required. There are no hard and fast rules as to the number of workings required to produce the desired seed bed, these being governed largely by the implements used and the effect of local seasonal conditions on regrowth of native grasses and weeds. There should be sufficient cultivations over a period of several months to control all regrowth and to produce a well-worked weed-free seed bed by planting time.

On the granite and traprock soils, cultivation with tined implements is preferable to the use of disc machinery which has rather a drastic effect on soil structure. When surface trash is a problem, disc implements are necessary. The chisel plough has become popular and has proved to be a suitable implement for seed bed preparation.

Plate 2

White Clover Regenerating on Traprock in a 4-year-old Pasture.

Most of the cultivations are on sloping country and it is therefore important that consideration be given to soil conservation measures. If the cultivation is likely to be affected by run-off water from higher country, protection with either a diversion bank or pondage bank is necessary. The diversion bank is used for the larger catchments and the pondage bank for smaller catchments.

On the gentle slopes, contour cultivation is frequently quite adequate to minimise erosion. Although some erosion may result from storms prior to pasture establishment, subsequently the established pasture will provide sufficient control.

In the case of steeper slopes it may be necessary to build contour banks. These may be constructed to hold the run-off water on the paddock, thus providing additional moisture, over a period, for the pasture. It is most unwise to cultivate natural watercourses.

Sod seeding has not been carried out on a large scale. In this method of pasture improvement, legume seed is introduced into the native pastures without any prior cultivation. This process has rarely been successful under Queensland conditions, and further trial work is to be carried out.

2. *Time of Sowing*.—A March to early May sowing is desirable if winter-growing species are to be planted. Lack of rain in some years may make this impossible and there are many instances of June and July sowings being quite successful. In the Granite Belt an early planting is preferable because late sown pastures make no progress until the warmer weather in spring. If plantin annual species, the earlier planting time is als necessary in order to allow time for seed setting Most of the subterranean clovers require a perio of cold weather before they will set seed and thu if planted in June or July the cold period i insufficient and usually poor seed setting results On the other hand lucerne can be sown in virtually any month of the year although it is advisabl not to plant during mid-summer.

In the case of winter pastures, seed bed preparation should be commenced by mid-November leaving about 4 months in which to prepare th ground. The pasture can then be planted following good rain from March to May.

For summer-growing species, mid January t mid February is a suitable planting time. Thi usually coincides with a good rainfall period an if planting is carried out before the end o February the young plants make sufficient growt to withstand the frosts.

3. *Planting Machinery*.—A seed drill or combine is most frequently used. A machine fitte with a small seeds box is an advantage but i this is not possible sowing can be effected throug the grain box, the seed being mixed with sawdust, or through the fertilizer box mixed wit fertilizer. Where legume seed has been inoculated a neutralised fertilizer such as basic superphosphate should be used in this latter case Some combines can be fitted with a reductio gear for the grain box enabling the sowing o small seeds without a carrier.

4. *Seed Inoculation*.—This only applies to th legumes and it is recommended that, prior t sowing, all legume seed be inoculated with th correct strain of nitrogen-fixing bacteria. If th correct strain of bacteria (Rhizobium) is no present in the soil and if the seed has not bee inoculated very poor legume growth and eve death of the plants will result. This applies i particular to the granite soils.

5. *Depth of Sowing*.—Pasture seed should b sown as close to the surface as possible and unde no circumstances should be sown deeper tha 1 in. If there is a tendency for the machine t plant deeply the hoses should be removed from the hoes and the pasture seed broadcast on the surface. This will then be covered by the ligh trailing harrows. Rhodes grass, green panic and buffel grass give best results if broadcast and the lightly covered by the harrows.

6. *Fertilizers*.—In both the granite and traprock the major plant nutrients are in poor supply

particular this applies to phosphorus in the ınite soils, where it is recommended that mixed stures be sown with at least 1½ cwt. of super- osphate to the acre. Higher quantities can be ed to advantage and in any case during the tial years annual topdressing is required. perimental work has not yet indicated how ıch phosphate should be used but topdressing ould be continued until at least 6 cwt. of super- osphate have been added. If planting high- tility-demanding grasses such as the rye grasses prairie grass, annual topdressings of a mixed tilizer containing both phosphate and nitrogen advisable. This is important if the legume mponent of the mixture is weak and therefore able to supply sufficient nitrogen to the grasses. cerne establishment in the granite belt has been satisfactory in a number of cases and it now pears that correction of soil acidity with about f a ton of lime to the acre is necessary before nting. Experimental work is still being con- cted along these lines.

Although the traprock soils are low in phos- ate, a pasture response to added superphos- ate has not been demonstrated. It is most ticeable that stock congregate and feed on any dressed areas in a paddock and it would refore appear advisable to plant pastures with perphosphate. This could result in a better ablishment through quicker initial growth and supply to the stock a nutrient which would erwise be lacking in the diet. Nitrogenous dressings are also recommended, particularly cases where legume growth is poor and the ociated grasses require a soil of good fertility. rogenous fertilizers are expensive but until a thod of promoting vigorous legume growth can determined they are recommended.

Trace element responses have not been demon- ated in pastures on either soil type.

7. *Establishment with a Cover Crop.*—Pasture ablishment with a cover crop has rarely been sfactory and consequently this practice is not ommended. On the other hand, however, ny stands of lucerne have been established cessfully under a crop of either oats, wheat or corn. Successful establishment is dependent favourable seasonal conditions and therefore element of risk is introduced. A light sowing of the cover crop is necessary (20 lb. to the e as a maximum) and a crop with a poor bling habit is advisable. In this respect wheat rye corn are preferable to oats but if using s an upright variety should be selected.

If favourable growing conditions are experienced during the spring, the cover crop can be allowed to mature and the grain harvested. If a dry season is experienced it is preferable to graze the paddock when the lucerne is well established, which would be about 10 to 12 weeks after planting.

8. *Pre-cropping.*—Pre-cropping of the traprock and granite soils is only recommended when there is insufficient time to prepare the seedbed satisfactorily for pastures. The practice of sowing an annual crop into a roughly prepared seedbed for the first year is quite common. Following the crop the ground can be worked quite rapidly into a satisfactory condition for pasture. If adopting such a procedure, a winter crop is necessary. Continuous cropping over a period of several years will result in a rapid breakdown of soil structure, making subsequent pasture establishment increasingly difficult. Under such conditions, couch grass rapidly invades granite soils, and traprock soils become powdery and set like cement following rain. A desirable programme is to thoroughly prepare the ground from the virgin state, and to plant pastures or lucerne. These stands will deteriorate in time and the area should then be cropped for 1 or 2 years and replanted to pastures or lucerne.

9. *Pasture Establishment Costs.*—The question of pasture establishment costs is a very difficult one to answer as there are so many variable factors. The following figures vary between quite wide limits but at the same time serve to illustrate the outlay which is involved. It has been assumed that cultivation and planting machinery is owned by the landholder and apart from clearing operations it has not been necessary to engage contractors. The following estimates do not include depreciation of the machinery required:

(1) *Clearing*	Cost/Acre
Limited stick picking and burning of dead trees and stumps	£1
(*No outside labour involved*)	
Where bulldozing of standing timber is required, involving outside labour	£5 to £15

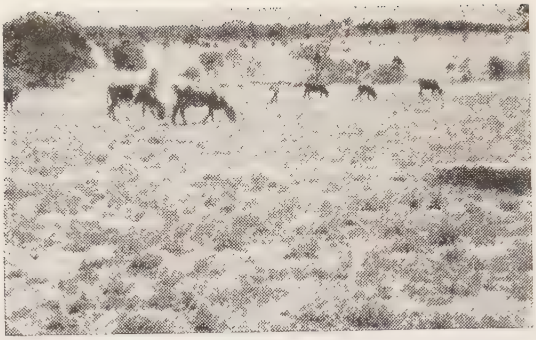


Plate 3

Cattle Grazing Lucerne on Granite Soils.

(2) *Seedbed preparation*	
Cost of fuel, replacement parts and labour . .	£1 5s. to £2 10s.
(N.B.—There will be a considerable variation depending on the number of cultivations required. The minimum would be one chisel ploughing, one discing and one harrowing.)	
(3) *Planting*	7s.
(4) *Seed*	£1 5s. to £3
(5) *Fertilizer*	up to £1 10s.
(6) *Fencing*	about £4

Pasture Management

Grazing.—If it is realised that pasture improvement is a long-term project then it can be readily understood that management practices must be adopted which will ensure maintenance of a productive stand for as long as possible. It is a very simple matter to overgraze a pasture in the early stage, and, at all costs, this should be avoided. Poor productivity of pastures in the second year and loss of sown species can frequently be attributed to over-grazing during the early life of the stand.

Grazing management will have a vast influence on the botanical composition of the pasture. Grazing of annual species at the time of seed setting will seriously reduce the population in the following season. No perennial species can withstand prolonged periods of heavy grazing and therefore a grazing rotation which will allow for regular spelling of the pasture is necessary, especially when mixtures with differences in palatability are used.

Legume growth can be influenced by time o grazing and grazing methods. Where grass i allowed to become coarse and rank, the shadin effect will usually prove detrimental to the clover and where heavy grazing is practised a clove dominance may result.

Renovation.—There is ample evidence throughout the district to indicate that an annual renovation can assist markedly in the germination o annual grasses and clovers. This applies in particular to the subterranean clovers, barrel medic burr medic, rye grasses and perennial prairi grass. In such cases renovation should be carrie out preferably when the soil is moist and at th time of the year when germination would normall be expected. In the case of winter species, thi would correspond to periods of good moistur towards the end of summer. Renovation o perennial species must be handled with care. A notable exception in this case is phalaris, whic usually responds quite well to periodic renovations. In general, however, the perennial specie are affected adversely and renovation would onl be recommended when there is a good chanc of stimulating regeneration of the annual specie in the pasture mixture even at the expense of th perennial species. Renovation has the advantag of opening the soil, allowing greater moistur penetration and discouraging regrowth of nativ grasses and weeds. The implement most commonly used is the chisel plough.

Recommended Pasture Mixtures

TRAPROCK SOILS

1. *Lucerne* (4 lb. to the acre) sown as grazing stand has proved to be a valuabl supplement to the native pastures. Althoug lucerne is a summer growing species, and it i during this period that high stocking rates ar possible, a very useful green pick suitable fo sheep is frequently available throughout th winter. If planted into a well-prepared seed be and properly managed, at least 5 years of goo production can be expected. It also has th added advantage of being cheap to sow.

2. *Lucerne* (2 lb. to the acre) and *Wimmer* Rye Grass (6 lb. to the acre) is a useful mixtur if soil fertility is maintained. The addition of grass also minimises bloat problems. Rye gras will usually produce well in the first year bu for good production in subsequent years nitrogenous fertilizers may be necessary.

3. *Lucerne* (2 lb. to the acre) and *Perennia Prairie Grass* (10 lb. to the acre). This mixtur

alls into the same category as the previous one nd to ensure persistence of the grass maintennce of soil fertility is necessary.

4.	*Lucerne*	1 lb. to the acre
	White Clover	2 lb. to the acre
	Mt. Barker Sub Clover	2 lb. to the acre
	Phalaris	2 lb. to the acre
	Cocksfoot	2 lb. to the acre

This is similar to the original mixtures sown hroughout the district. It is suitable for irrigaion but has limitations under dryland conditions. roduction from such a mixture is entirely lependent on favourable weather conditions and onsequently in some years very little feed is vailable. Usually after about three years, nvasion by the native grasses takes place coniderably reducing the persistence of the pasture.

GRANITE SOILS. Lucerne is not yet a eneral recommendation throughout the granite, nd the pasture mixtures are based on clover arieties.

1.	*White clover*	2 lb. to the acre
	Mt. Barker or Tallarook Sub Clover	2 lb. to the acre
	Phalaris	2 lb. to the acre
	Cocksfoot	2 lb. to the acre
	Wimmera Rye Grass	2 lb. to the acre

This mixture has been quite useful particularly n the wetter areas of the granite such as in the alveen district. Invasion by native grasses has mited the productive life of the stands to about years. It is in the granite soils that excellent egeneration of the annual species has resulted ollowing a renovation in late summer.

2.	*White Clover*	2 lb. to the acre
	Subterranean Clover (Tallarook or Mt. Barker)	2 lb. to the acre
	Perennial Prairie Grass	10 lb. to the acre
	or *Wimmera Rye Grass*	6 lb. to the acre

Persistence of this mixture would depend rgely on maintenance of soil fertility and eriodic renovations.

3. *Lucerne.* Lucerne sown as a grazing stand the rate of 4 lb. to the acre has been an xcellent producer on some granite soils. Unfornately large-scale recommendations cannot be ade owing to many establishment failures of is legume. If it is known that lucerne will row on the property it is recommended that it be sown at the 4 lb. rate as a grazing stand or alternatively at half the rate in a mixture with Wimmera rye grass (6 lb. to the acre) or perennial prairie grass (10 lb. to the acre).

Pasture Returns

Improved pastures throughout the district are being used primarily for breeding, growing of young stock and fattening both sheep and cattle. This has resulted from the fact that the majority of properties have insufficient pasture from which all the stock can benefit. Consequently those stock which are most likely to give the greatest returns from the smaller areas are given access to the pastures.

For instance, improved pastures are rarely used for wool growing because invariably insufficient pasture to cater for all the wool growing sheep has been planted. In addition with present-day wool prices it would take a considerable time to pay for the improvements on wool returns alone. Also increased carrying capacities are only possible when a considerable proportion of the property has been sown (about 15 to 20 per cent). The average stocking rate on

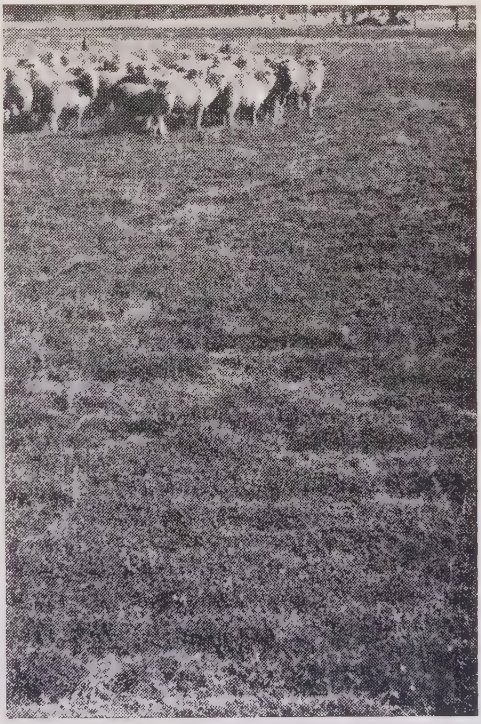


Plate 4

Sheep Grazing Improved Pastures on Granite Soils.

Plate 5

Five-Year-Old Pasture on Granite Soils.

unimproved pasture is about 1 sheep to 1½ acres or 1 beast to about 7 acres. This varies according to the locality. Breeding and fattening on the native pastures alone is very much dependent on favourable seasons. Frequently, lambing percentages are low, young stock make very poor growth and fattening is only possible in good seasons. These points have been overcome to a considerable extent with pasture improvement. Many sheep men are now not only successfully breeding stock replacements but also breeding a surplus of lambs for the fat lamb market. Cast-for-age wethers can be fattened following shearing instead of having to sell as store sheep at a very much reduced price. Recently one property fattened 1,744 culled wethers off shears in 6 months on 500 acres of lucerne. The cattlemen have found it possible to fatten store stock in one season instead of the usual two off native pastures and are able to produce baby beef from their own bred steers.

Detailed information on the economics of pasture improvement is not yet available, but some actual cases of returns gained from improved pasture are given:

Case I

An area of 200 acres costing £10 an acre to plant was sown in March, 1955. During the financial year 1955-56, 130 head of cattle were fattened; 40 of these were marketed as fats in September, 1955, and the remaining 90 were fattened by March 1956. On native pastures these beasts would have been worth £28 per head as stores. As fats from improved pasture they realised £38 per head. In 1956, 140 fat lambs were sold at £4 a head and by June, 1956, a further 240 lambs were ready for market.

On the same property, yearling vealers after 3 months on sown pastures have dressed out at 320-350 lb.

Case II

An area of 200 acres of improved pasture was laid down at a cost of approximately £6 an acre excluding depreciation on machinery. In 1 year, the following returns were obtained:

75 acres turned off 424 fat lambs which were sold at £3 5s. a head. The remainder of the area fattened 443 wethers realising a net profit of £1 a head. In addition, the poorer flock animals were lifted in condition and culled, wethers off shears were fattened and sold for £3 12s. 6d. a head instead of being sold as stores at the then current price of £2 a head.

Of interest are some actual stocking rates from both pastures and grazing lucerne in the traprock and granite:

1. *Traprock Lucerne*: June, 1959–June, 1960.
    For the 12 months—3 sheep to the acre.
    For the 6 summer months, October 1959–March 1960—4 sheep to the acre.
    For the 6 winter months, April–September —2 sheep to the acre.

This paddock was grazed for periods from 10 to 40 days at the rate of 7 sheep to the acre.

2. *Traprock Pasture*: June, 1959–June, 1960.
    For the 12 months—2 sheep to the acre.
    During the winter period (April–September) —3 sheep to the acre.

From July 19 to August 21 this paddock was grazed at the rate of 15 sheep to the acre.

3. *Granite Lucerne*:
    For the 6 summer months, October–March 4 sheep to the acre.
    From first week in November to first week in March—7 sheep to the acre.
    For the winter period—1 sheep to the acre.

POINTS TO CONSIDER

Before commencing a pasture improvement programme, careful consideration should be given to these questions:

1. For what purpose is the pasture being planted?
2. Is the area large enough to fulfil this purpose?
3. Can the pasture be managed so that feed will be available when it is required?

Species Performance

Since 1953, a considerable range of pasture species has been planted throughout the district.

Many of the not-so-common species have been restricted to small observational plots but records of their performance have been kept. In the following table a brief description and a few comments on some of the pasture plants are given:

Name	Nature of Plant	Sowing Rate per acre	Sowing Time	Period of Growth	Comments
ucerne	Upright-perennial	4–5 lb. pure stand	March–August	Sept.–March	Peak of production during summer months Useful pick available during winter months. Productive life of stand approximately 4–6 years. Recommended for the traprock. Limited in the granite soils. Requires a well-drained site
arrel medic	Prostrate-annual	2 lb. in mixture	March–May	April–October	Performance has been better on the traprock than the granite. Has given good persistence in the traprock. Production only mediocre. Light stocking is necessary September–October to allow seeding.
arrel medic 173	Prostrate-annual	2 lb. in mixture	March–May	April–October	Very little difference to commercial Barre medic.
arbinger Medic	Prostrate-annual	..	..	..	Recently released from Mallee Research Station in Victoria. Is similar to barrel medic but sets seed about 2 weeks earlier. Was planted in a trial plot at Texas, 1960.
ack medic	Semi-erect annual	2 lb.	March–May	April–October	Not a general recommendation for the district. Persistence and production has been poor.
oolly Burr Medic	Prostrate annual	..	..	..	Has not been included in pasture mixtures. Is frequently found growing naturally particularly in the traprock. In the New England district of New South Wales it usually indicates a soil sulphur deficiency.
hite Clover— New Zealand	Prostrate perennial	2 lb. in mixture	March–July	April–November	Requires good soil fertility and good moisture. Excellent for irrigated pastures. Has given good persistence in dryland pastures. Production dependent on seasonal rainfall. Will not withstand pasture renovation. Well suited to the granite soils particularly in the Dalveen area. Will regenerate from seed. Occurs naturally in favoured localities.
Ladino	Semi-erect perennial	..	..	..	Has been useful addition in irrigated pastures. Has not been recommended for dryland pastures.
Louisiana	Prostrate annual	..	..	..	Has not been recommended to date. Is a prolific seeder. Was planted in an observational plot at Texas.
d Clover	Semi-erect perennial	2 lb. in mixture	March–May	April-Dec.	Requires good soil fertility. Poor persistence under dryland conditions. Is susceptible to virus diseases causing leaf curl ; not generally recommended.
bterranean Clover	Prostrate annual	2 lb. in mixture	March – early May	April–Oct.	Useful addition in pasture mixtures. Persistence has been better on the granite soils. Regeneration can be encouraged by an annual renovation in February. Light stocking is necessary during seed setting periods which varies for the different strains from late August to early October.
Dwalganup	Prostrate annual	..	..	..	An early strain setting seed usually by early September. Quite well suited, is susceptible to rust.
Yarloop	Prostrate annual	..	..	..	Also an early type ; is later and more leafy than Dwalganup ; vigorous growth in early stages.
Clare	Prostrate annual	..	..	April–Oct.	Also an early type ; is vigorous in early stages. No large scale sowings to date.
Bacchus Marsh	Prostrate annual	..	..	..	Mid-season variety ; setting seed towards end of September.
Mount Barker	Prostrate annual	..	..	..	Mid-season variety ; widely recommended.
Tallarook	Prostrate annual	..	..	..	Late flowing type ; seeding during October. Widely recommended but seed setting can be adversely affected during a dry spring.

Name	Nature of Plant	Sowing Rate per acre	Sowing Time	Period of Growth	Comments
Rose Clover	Erect annual ..	2 lb. in mixture	March–May ..	April–Oct. ..	Was planted in an observational plot at Texas in 1959. Season was unfavourable and performance poor.
Ball Clover	Prostrate annual ..	1 lb. in mixture	March–May ..	April–Oct. ..	Is appearing naturally in many areas of the traprock and granite. Has not been recommended in mixtures to date.
Crimson Clover ..	Erect annual ..	2 lb. in mixture	March–May ..	April–Oct. ..	Did not regenerate in plots at Texas. Performance did not equal subterranean clover.
Strawberry Clover ..	Prostrate perennial	1–2 lb. in mixture or alone	March–May ..	April–Nov. ..	Only recommended for swampy areas.
GRASSES— Phalaris tuberosa ..	Perennial	2–3 lb. in mixture	March–June ..	April–Nov. ..	Good performance on all soils. Productive life of 4–6 years. Does not regenerate from seed, can be encouraged with a renovation. Excellent for irrigated pastures.
Phalaris arundinacea	Perennial	2–3 lb. in mixture	Feb.–March ..	August–Dec. ..	Thrives under moist conditions. Has not been recommended for dryland pastures.
Tall fescue	Perennial	2–3 lb. in mixture	March–June ..	April–Oct. ..	Performance has not been superior to phalaris. Is usually not recommended.
Rye Grasses— Perennial	Perennial	2–5 lb. in mixture	March–June ..	April–Oct. ..	Requires good rainfall and high soil fertility. First year production usually good but nitrogenous fertilizer necessary for subsequent years. Frequently the plants are killed out during the heat of summer but regeneration from seed is satisfactory.
H. I. Rye grass ..	Biennial	2–6 lb. in mixture	March–May ..	April–Oct. ..	Performance has not been as satisfactory as perennial rye
Italian Rye grass ..	Annual	2–6 lb. in mixture	March–May ..	April–Oct. ..	Performance has not been as satisfactory as perennial rye
Wimmera Rye grass	Annual	2–6 lb. in mixture	March–May ..	April–Oct. ..	As for perennial rye. Renovation in February plus nitrogenous fertilizer will assist regeneration.
Cocksfoot— Akaroa	Perennial	2–3 lb. in mixture	March–June ..	April–Nov.	Excellent in irrigated mixtures. Persistence from 2–3 years in dryland mixtures. Production is dependent on suitable rain. Does not require a high soil fertility.
Aberystwyth ..	Perennial	2–3 lb. in mixture	March–June ..	April–Nov.	
Danish	Short lived perennial	2–3 lb. in mixture	March–June ..	April–Nov.	
Perennial Veldt ..	Perennial	2–3 lb. in mixture	March–June ..	April–Nov. ..	Recommended only for sandy soils. Is not as good as phalaris.
Perennial Prairie ..	Perennial	12–15 lb. pure stand 4–6 lb. in mixture	March–June ..	April–Dec. ..	Requires good soil fertility. Nitrogen topdressing recommended. Heavy producer under irrigation.
Green panic	Perennial	3–4 lb. pure stand	Sept. or Jan.–Feb.	Sept.–March ..	Useful summer grass for good paddocks. Will not stand short grazing. Good seedling regeneration following renovation of an old stand.
Rhodes grass ..	Semi-erect perennial	3–4 lb.	Sept. or Jan.–Feb.	Sept.–March ..	Useful summer grass but inclined to become stalky if nitrogen level of the soil is depleted.
Buffel grass	Perennial	3–4 lb.	Sept. or Jan.–Feb.	Sept.–March ..	Very few successful stands in the district. Cloncurry, Biloela and Gayndah the most suitable strains for use.

Top: Portion of 14,000 Sheep Sold at Terrick Terrick Stud, Blackall, in April, 1960.

Bottom: Sellers, Buyers, and Viewers at the Terrick Terrick sale.

Concreting The Trench Or Pit Silo

By M. J. RADEL, Adviser, Animal Husbandry Research Farm, Rocklea.

With present-day emphasis on the conservation of fodder in the form of silage, it is most important that sufficient thought be given to the construction of the silo.

Most of the tower silos in use in Queensland are constructed of concrete. Does this mean that it is necessary to concrete the trench type silo? Old slabs or sleepers would help to a certain degree to stabilize the pit, but as we realise, concreting is the only permanent form of work.

The following are a few reasons why concreting of the walls and floor of the trench is desirable:

1. The wall is stabilized. This is an important consideration where the soil type is such that "fall in" is common.
2. The earthy musty smell, which is so prevalent in silage near the sides when they are of natural formation, is avoided.
3. Excess water, which can leach out the lactic and other preserving acids, is excluded from entering through the sides during and after rain.
4. Excess moisture can drain away, allowing access to the silo at all times without fear of bogging. The approaches to the trench are important factors also and should be covered with a coarse gravel to provide good drainage and give support for heavy loads. It can be seen on Plate 1 how muddy and inaccessible the trench can become after rain.
5. The solid base provided by the concrete prevents much of the loss which occurs when silage is being fed out from trenches with floors of natural formation.
6. A concreted trench is a permanent asset to any farm.

Because of these advantages, one of the self-draining trench silos in use at the Animal Husbandry Research Farm, Rocklea, was concreted. The methods used may be of interest to primary producers who are contemplating making some of their trenches into more permanent constructions. All the work was carried out with farm labour. The main feature was that very little boxing timber was used to maintain the wet cement during concreting.

Shaping the Silo

The dimensions of the trench were: length 36 ft., width of floor 10 ft., height at the back 7 ft., tapering to about 2 ft. at the mouth. It should be possible to conserve 60 tons of silage in such a trench.

Because the common methods of excavating a trench leave uneven walls and floor, it was necessary to trim them. Firstly, a batter of approximately 1 in 3 was put on the walls and the floor trimmed to have approximately 2 ft. fall to the

Plate 1

Showing How Boggy the Pit Can Become. This tractor was bogged 8 ft. from the silage face.

mouth of the pit. Next, the toe of the walls was "picked" off, to allow the floor to extend 12 or 15 in. in under the bottom of the completed wall. This provided a support when both wall and floor were joined later, and allowed room behind the concrete wall for a mitre drain. This extended to the mouth of the pit in order to take off any excess moisture.

The pit was then ready for cementing.

Concreting the Floor

Next the floor was broken into six bays and boxed off with timber to a depth of 6 in. A layer of rock was put into each bay and cemented with a 4–2–1 mixture using reinforcing mesh, not forgetting the 12 to 15 in. overlap for a wall support, as mentioned.

An important point at this stage was the pressing of reinforcing mesh into the wet cement across the full width of the bay, leaving about 15 to 18 in. protruding above the floor where the wall, when made, met the floor. This served to tie the wall and floor together when the walls were concreted later.

This 6 in. reinforced concrete floor should be quite suitable for carrying heavy loads, and draining off moisture.

The Walls and Back

In constructing the walls and back, the only boxing timber used was 4 in. x 1 in. or 4 in. x 2 in. to split the bays. Six equal bays were used for each side, the back being done in one slab later.

Reinforcement was then placed in these bays 2 in. from what was to eventually be the face of the walls, this being the correct position to counter stress from behind and give maximum strength.

Spikes 12 to 15 in. long, made from old iron or pipe, were then driven into the bank in rows, both to hold the mesh in place and act as additional reinforcing material, and to support small stones which were then placed behind the mesh. All these items not only act as reinforcing agents but help to hold the "green" cement in place.

The same 4–2–1 mixture was used on the walls and this was finished off with a plaster coat to give a good surface and better seal.

Particular care was taken in mixing the concrete for the walls. If a little on the dry side it was much easier to handle than a mixture that was too wet.

The back wall was put in the same way as the sides, but it was necessary to join the two together with a V-shaped gusset of concrete in each corner.

The gravelled entrance and the completed trench are shown in Plates 2 and 3.

Plate 2

Gravelled Entrance to the Trench Silo Allows Easy Access at all times.

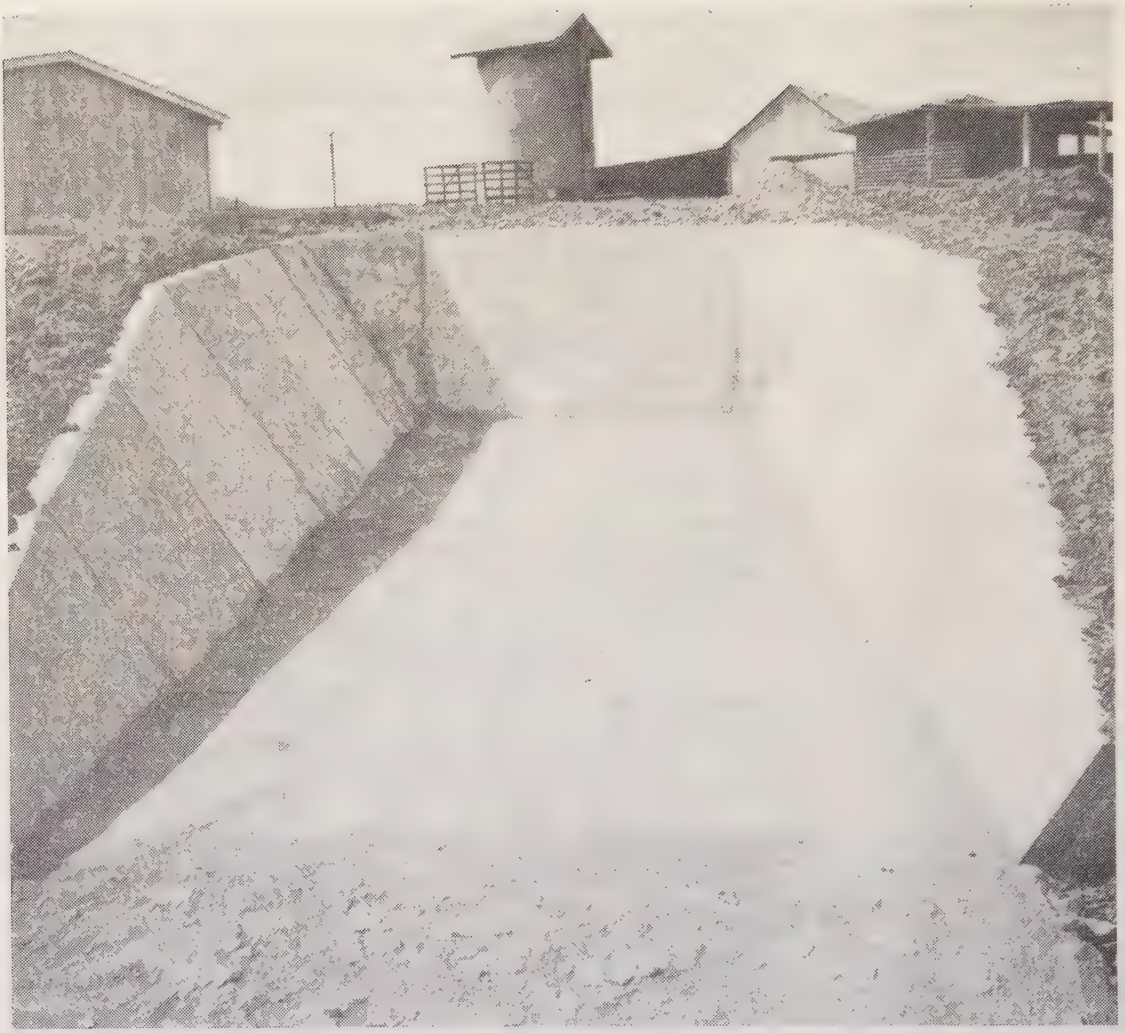


Plate 3

The Finished Concreted Trench Silo, as Made at Rocklea. A conventional concrete tower silo is in the background.

Costs

All that now remains is the cost assessment. For the pit concreted at Rocklea, these costs were involved:

	£	s.	d.
Wages	91	0	0
Cement	24	6	0
Sand	8	2	0
Gravel (for concreting)	13	10	0
Reinforcement material	12	10	0
Crusher run gravel (for approaches)	5	5	0
Total	£154	13	0

This may seem quite an outlay at one time, but as you may notice, all the material used at Rocklea had to be purchased, whereas some farmers may be able to obtain materials, such as sand and gravel, more readily at a lower cost.

Taken over the number of years in which the pit could be used, the cost per ton would be very small and the money well spent.

cale Insects On Papaws

By A. R. BRIMBLECOMBE, Senior Entomologist.

Commercial papaw growers in central and uthern Queensland are not troubled by scale ect infestations. Five species of scale insects e, however, recorded from papaws in the uthern part of the State.

These are the soft brown scale *Coccus hes- idum* L., the San Jose scale *Quadraspidiotus niciosus* (Comst.), the latania scale *Hemiber- ia lataniae* (Sign.), the clavate scale *Clavaspis culeana* (Had.), and the plumose scale *organella longispina* (Morg.).

Infestations by these insects on papaws are always localised to a few fruit or a few nearby plants and are usually of short duration. In most instances they have been light and confined to the fruit. Heavy infestations of soft brown scale may occur also on leaves and San Jose scale on stems but are soon eliminated by destruction of the few plants concerned. Such infestations are always heavily parasitised and the general operation of natural enemies no doubt assists markedly in restricting the activities of these insects.

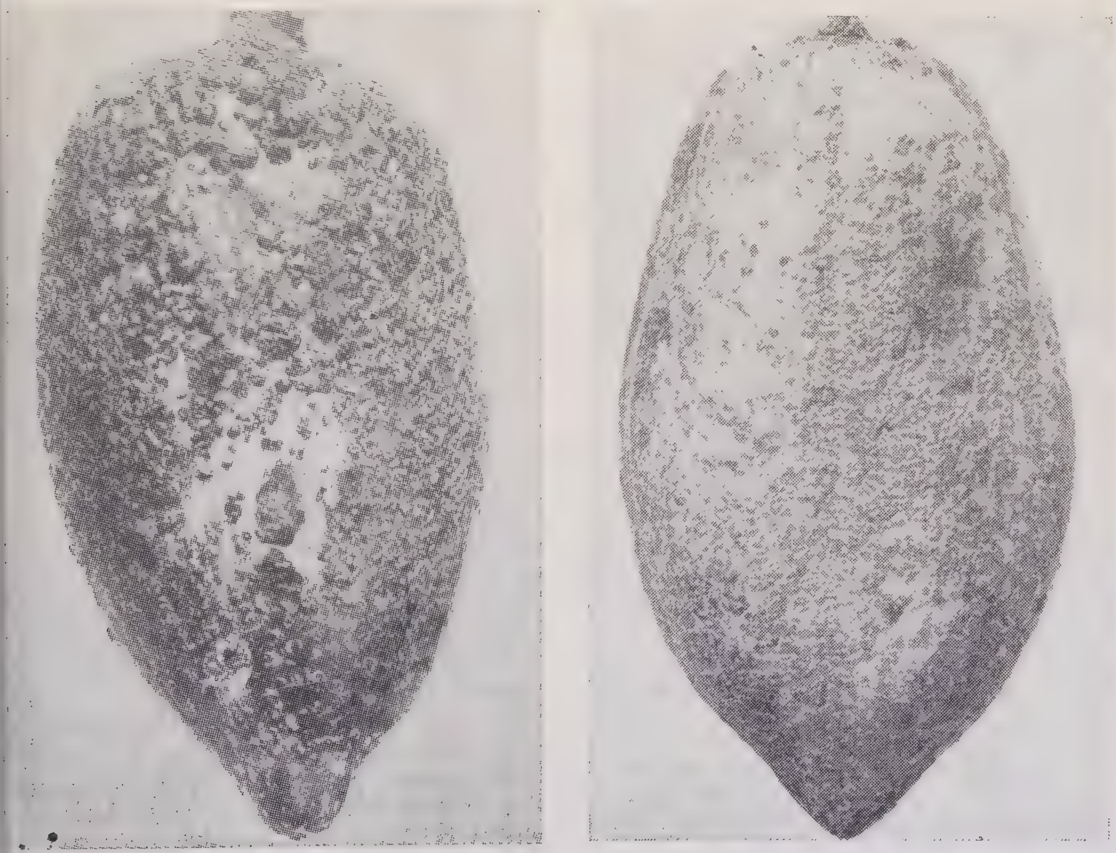


Plate 1

Papaw Fruit with Heavy Infestation of (left) Soft Brown Scale, and (right) Oriental Scale.

A more serious scale insect occurs on papaws on Thursday Island in the far north of the State. This is the oriental scale *Aonidiella orientalis* (Newst.). It is known to occur also on papaws in the Darwin area, probably having come to Australia from southern Asia.

Heavy and persistent infestations occur on both fruit and stems. A survey of host plants on Thursday Island has not been made. In other countries, however, infestations are known on a wide range of commercial and ornamental plant These include avocado, citrus, custard appl banana, mango, carnation, eucalyptus, hibiscu oleander and frangipani.

The only chemical control so far known to b applicable to the oriental scale is white oil whic under tropical conditions may sometimes be c doubtful value. Papaw growers in other parts c the State should not obtain any plant materi from Thursday Island.

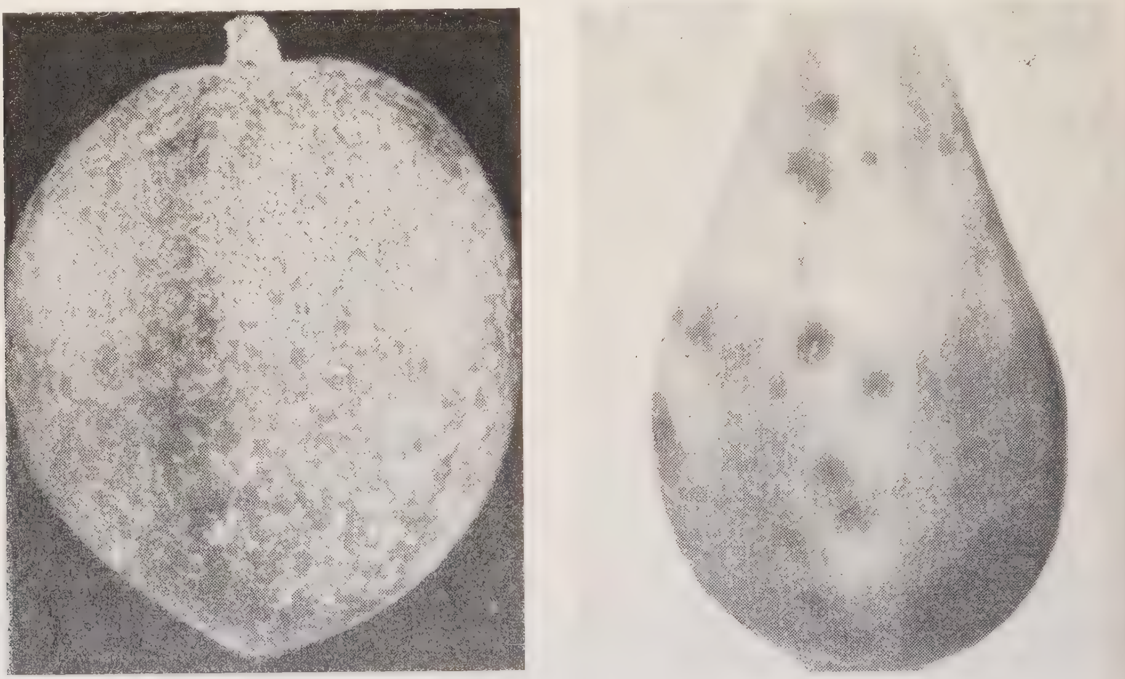


Plate 2

Papaw Fruit with (left) Heavy Infestation of San Jose Scale, and (right) Light Infestation of Clavate Scale.

◆

Europe's Two Marketing Groups

Most people are a bit confused about the marketing set-up in Europe that is expected to affect the export prices of Australian farm produce in due course.

Europe now has two separate marketing groups.

The first consists of six countries, who, by the Treaty of Rome in 1957, set up a common market to liberalise trade among themselves. These countries are Belgium, France, West Germany, Italy, Luxembourg and the Netherlands. This group is known as The Six.

The second group, known as The Seven, wa set up by the Stockholm Treaty of 1959. consists of Austria, Denmark, Norway, Portuga Sweden, Switzerland and the United Kingdom The idea of The Seven is also to liberalise trac among themselves.

The main difference between the two grou is on external tariffs. The Six are aiming uniform duties on imports from non-member The Seven, which you remember includes th United Kingdom, are retaining their own tari and trade policies to non-member countries.

—*C. W. Winders, Officer-in-Charge,*
Information Branch.

anana Growing In Queensland—2.

ontributed by the Horticulture Branch.

The banana is a gross feeder and makes heavy mands on the available plant foods in the soil. any different fertilizers have been used, but mixture with a nitrogen-phosphate-potash rmulation of 8:10:8 or thereabouts is suitable r most of the soils in southern Queensland on ich bananas are grown. In the north, however, tter results are obtained with a 5:7:23 or nilar mixture which is rich in potassium. The e of application depends on the planting dis- ice and the fertility of the soil but is usually om 1 to 1½ tons per acre per year.

The first application is made when most of plants have appeared above ground level, 1½ lb. of fertilizer being distributed over each ol site and lightly worked into the surface soil. second application at the rate of 1½–2 lb. per ant is required two months later, and a third the end of a further two months. In this y, the young plant receives the whole of its tilizer in three applications before it is four onths old.

As a plant grows, the roots gradually move out om the corm, until, in the fully grown plant, ere are comparatively few feeding roots within ft. of the base. Th second fertilizer application ould, therefore, be broadcast in a uniform band –2 ft. wide round the plant about 1 ft. from base. The third dressing is applied similarly a slightly wider band and correspondingly ther out from the base. The fertilizer is lightly pped into the soil.

A similar fertilizing programme should be lowed in the ratoon crop, the follower being ated as though it were a new plant and the es of application determined accordingly, the t being made when the sucker is 12–18 in. h. In first and second ratoon crops, however, the fertilizer should be applied in a semi-circular band on the side of the stool where the sucker is situated. After the third and subsequent ratoons, the fertilizer may be broadcast in a wide band between the rows.

In plantations where the plants lack vigour, an additional dressing of 2 oz. of sulphate of ammonia per stool may be used with beneficial results. These supplementary dressings to backward plants can, if necessary, be applied each month for up to three or four months; they do much to even out bunch development in the plantation. Similar treatment is sometimes desirable in ratoon crops to improve fruit filling. Such treatments should not be made during dry weather, as an accumulation of sulphate of ammonia at the base of a stool may damage the plants under these conditions.

On the red basaltic soils which are used extensively for banana production, dressings of ground limestone or dolomite are often applied with good results at intervals of about three years. Both ground limestone and dolomite may be broadcast at the rate of 1½–2 tons per acre in early spring.

Weed Control

Weeds are apt to be troublesome in plantations established on replant land and on virgin land where the burn has not been satisfactory. On most plantations, especially those on steep slopes, weed control is achieved by hand hoe and weedicides; on lesser slopes or relatively flat land, horse-drawn or power implements can be used effectively, at least in the early life of the plantation. Cultivation must be shallow.

If the rainfall during summer is heavy, chipping is sometimes impracticable and ineffective. Weedicides may then be used to keep weed growth in check. Arsenic pentoxide and sodium arsenite are used extensively in Queensland for this purpose at appropriate strengths, which are specified by the manufacturers. Two applications at an interval of about one month should be sufficient to control weed growth in summer. The sprays are applied on calm days at 20–40 gal. per acre. The spray nozzles must be held close to the weeds. Care must be taken not to spray the banana stools, particularly when the suckers are comparatively small. Hormone weedkillers such as 2,4-D should not be used for the control of weeds in banana plantations. These preparations are highly injurious to banana plants and wind drift from any type of spray apparatus may cause considerable damage.

During the wet season, when competition for moisture is not a limiting factor to plant growth, the weeds may be brushed before they seed if chipping is impracticable and weedicides cannot be used effectively.

Cover Cropping

Cover cropping is practised in some banana plantations located in southern districts with a relatively heavy rainfall. Cow-pea is the usual crop but in tropical areas this plant tends to get out of control and climb over the stools. In districts with a rainfall under 50 in. a year, cover crops may compete with bananas for the available soil moisture during dry periods and the practice has, therefore, a local rather than a general application.

In a bearing plantation, the best results are obtained by growing the cover crop in a band less than 4 ft. wide between alternate rows of bananas. If the seed is sown in moist soil at about 20 lb. per acre during late October and either chipped in or buried by a rotary hoe operated with a shallow cut, the legume can be established very quickly. In young plantations from which bunches will not be cut during the growing period, the cover crop may be sown in every inter-row space.

During the period of most vigorous growth, usually late January and February, routine brushing may be necessary to keep the legume away from the stools. The amount of brushing required depends mainly on the variety of cowpea used, being relatively slight in strains with a semi-erect habit.

Mulching

Instead of cover cropping, the banana plantation may be mulched. Many different materials have been used for mulching in Queensland Blady grass is probably the best, since it does no rot down quickly and is usually readily available in quantity close to most plantations.

In applying the blady grass the material should be spread as uniformly as possible over the whole of the plantation to a depth of approximately 12 in. but not closer than 3 ft. to the base of the stools. This bare area around each stool facilitates fertilizing the young plants and ensures that sucker development will be normal. Weeds in the unmulched area can be hand-pulled if necessary. As the lower layer of grass gradually rots down, additional light dressings of mulch can be applied to maintain the initial thickness. Blady grass from about three acres of land is required to mulch an acre of bananas.

All weed growth should be destroyed, either by chipping or spraying, before the mulch is put down and if any perennial grasses such as common couch are present, these should be completely eradicated.

Selecting the Follower

The success or failure of a plantation as an economic venture depends not only on the careful selection of site and aspect, but also on setting the right type of sucker.

It is usual to select only one follower from each parent plant for the ratoon crop. Under this method of management, commonly referred to as the "one bunch–one sucker" system, the number of bunches per acre is controlled in order to ensure that they will be large and carry fruit of good quality. On very fertile soils, two suckers may be allowed to develop for the first ratoon crop, and under irrigation even a third may be permissible; but in either case only one sucker should be set on each plant in succeeding generations.

The sucker selected as the follower should be deep seated, spear-shaped, with a well-developed corm and narrow sword-shaped leaves. Shallow-seated, broad-leaved suckers lack vigour and rarely produce good plants.

On hillside country, the sucker selected for the first ratoon crop should be on the uphill side of the parent, preferably at an angle up and across the slope rather than directly behind the original plant. The rotting down of the butt of the parent plant after the fruit is harvested will not then weaken the follower, which still has

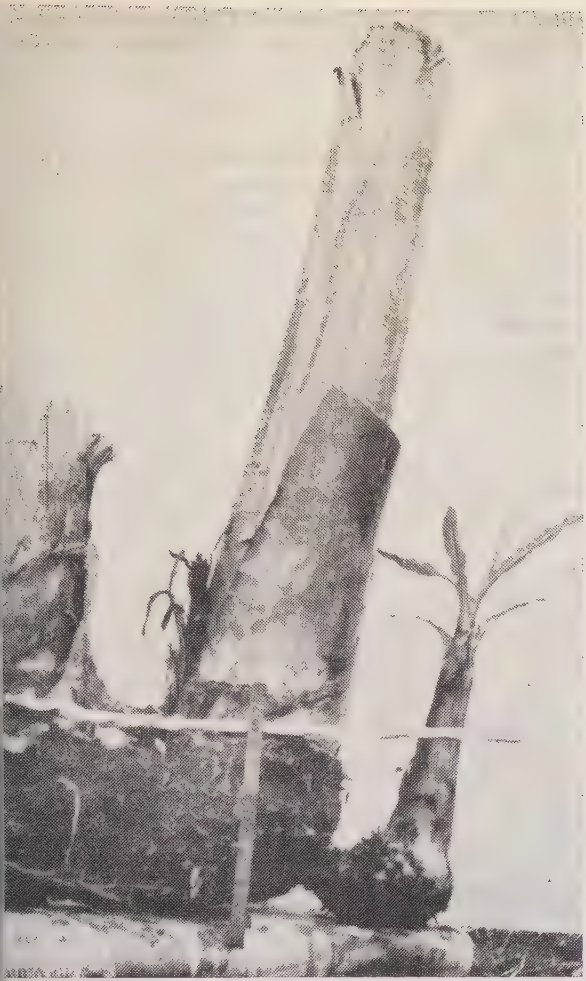


Plate 8: **The Straight Follow-through System of Setting the Follower for the Ratoon Crop.** The stool has been removed from the ground to show the position of selected followers. The straight line follower is usually deep seated and produces a very vigorous plant.

soil to support it on the lower side. The sucker should always be selected towards the side of the parent where it will receive the greatest amount of sunlight.

The first follower should be set before the parent plant throws its bunch. Since location, soil type, aspect and altitude all influence the time taken for a plant to bunch, the time of setting of the follower will vary with the plantation. Usually the best month for planting should be the best month for sucker setting, but in some areas allowance has to be made for the fact that ratoon plants often take a longer period to bunch than maiden plants. If the followers are all set about the same time, more uniform bunching for the next crop should be achieved.

The time of setting of the first follower to a large extent determines the success or otherwise of the plantation, for the behaviour of the crop in the third and subsequent years is governed by the management of the first ratoon. If two suckers are set for the first ratoon crop, each should be directed at an angle to the parent plant up and across the slope so that a large V is formed with the parent at the lower point.

The selection of suckers for the second and subsequent ratoons is based on what is commonly referred to as the "straight follow through" system. The "straight follow through" sucker arises more or less directly in line with the previous season's sucker and the original parent, and originates from a bud situated almost at the base of the corm. This fact ensures that it is firmly established in the soil and has a vigorous rooting system.

Desuckering

All sucker growth arising from the plant prior to or after the selection of the desired follower should be removed as soon as possible after its appearance. If allowed to remain on the parent plant, these unwanted suckers reduce its vigour, delay cropping and adversely affect yield. During spring and summer, when sucker growth is rapid, it is necessary to desucker the plantation at least once a month; during autumn and winter, when growth is less vigorous, desuckering at intervals of two or three months is normally sufficient.

Desuckering may be done with a special tool known as a gouge, made from a 3 ft. piece of 1½ x 1¼ in. spring steel. About 15 in. of one end is hammered out, and the edges turned up and sharpened. This "blade" is tapered to a point of about ½ in. across. The top of the gouge is generally fitted with a handle of ½ in. round iron for better leverage.

Where the plant to be removed is more than 6 in. above the soil surface, it should be cut off with a knife at ground level and the centre bored out by inserting the gouge and giving it one complete turn. In this way, the growing point of the sucker is destroyed and further growth suppressed without interfering with the rooting system of the stool. A few handfuls of soil are placed in and over the inverted cone-shaped cavity in each sucker treated.

Plate 9: **Hessian Bunch Covers.** In southern Queensland, fruit filling is frequently unsatisfactory during winter and spring. Fruit quality in bunches harvested at that time of the year is improved by fitting bunch covers in May.

Small suckers just showing through, commonly known as "peepers," may be gouged out in a similar manner, but in this case there is no necessity to cut the tops off first.

In recent years the use of a gouge has been largely superseded by the kerosene method of desuckering. The procedure is to cut the sucker off just above ground level with a sharp knife and then, using the point, gouge out a small central portion of the butt. About half a teaspoonful of kerosene is poured into the cavity, the quantity being increased slightly in the case of large suckers. The kerosene can be handled most conveniently if it is carried in a bottle fitted with a cork through which a piece of glass or metal tubing projects. This ensures that the liquid is not splashed on the parent pseudostem or spilled. Large oil cans are also useful for this work.

Trashing

Trashing is the removal of dead leaves from the the pseudostems of the plants. As the plant ages, the older leaves die and hang as a cloak of dead tissue which keeps the pseudostems cooler than would otherwise be the case and slows down the rate at which the plant and its associated suckers grow.

Trashing is usually carried out at the same time as desuckering, simply by cutting the dead leaves off with a knife where they bend over and hang down from the pseudostem. Tearing off the leaves opens up the leaf bases and results in damage to the pseudostem; the practice has nothing to commend it.

Propping

During the wet season, when strong winds frequently accompany heavy rain, the root system of the banana is often incapable of supporting a plant carrying a heavy bunch. Unless the plant is propped, it may be blown over. Dwarf Cavendish bananas require less propping than Mons Mari, while Lady Fingers rarely need propping at all.

Props are placed in position as soon as the last hand on the bunch has become visible. On steep slopes, the safest type of support is a double prop, made from two pieces of timber of equal length, fastened together by a bolt or piece of wire about a foot from the end. When the legs are spread the top forms a "V" in which the bunch stalk is held. This supports the bunch firmly, and, no matter how rough the weather, the prop cannot fall away and leave the bunch unsupported.

Single props are less cumbersome and reasonably effective in plantations on level ground or easy slopes.

When placing the prop in position, care should be taken to ensure that the fruit on the side of the bunch next to the pseudostem is not scratched or bruised, and also that the bunch hangs well clear of the prop.

The length of the prop will vary according to the variety of banana and the steepness of the land, but the prop should stand at an angle to the pseudostem. If the prop is too short and stands almost vertically, it has a tendency to lift the plant out of the ground, especially during wet weather.

The bunch flower, commonly termed the "bell," should be cut off when the bunch is about half mature, as its retention only increases the weight which has to be supported and to some extent delays the maturity of the bunch.

Bunch Covers

During the winter months, fruit blemishes are common and considerably reduce the value of even well-filled fruit. Bunches protected by suitable covers are invariably free from these blemishes and the fruit develops and matures more evenly than it would do otherwise. In practice, covers should be fitted not only to the bunches on partially defoliated plants but to all bunches which are likely to be harvested between May and November.

Chaff bags or corn sacks make suitable covers if the bottom of each sack is cut open, slipped up over the bunch and tied firmly around the stalk above the top hand. The other end of the bag is left open so that the fruit can easily be examined as the bunch approaches maturity. Plastic bags are specially manufactured for covering banana bunches and these are satisfactory when used on well-foliaged plants; they are less suitable for exposed bunches as they tend to accentuate sunburn damage on the upper hands.

Harvesting

Only fully-matured bunches of well-filled fruit should be harvested. However, bunches should not be left on the plant until the fruit begins to colour or the fingers will be so full that they split when being packed. A bunch is ready to cut when the fruit is evenly rounded without showing prominent ribs and the remains of the flowers break off readily from the tips when rubbed. Thin, angular, immature fruit should not be harvested under any circumstances.

For cutting bananas, a cane knife, reaping hook or large butcher's knife may be used. With the Cavendish variety the leaves are first cut and the bunch stalk is then severed above the top hand by a downward stroke of the knife, leaving sufficient length of stalk for easy handling.

Mons Mari and the tall varieties require a different technique, the exact method depending on whether or not the plant has been propped. If it is propped, a "V" cut which is deep enough to sever the bunch stalk in the middle of the pseudostem should first be made on the side nearest the prop about 6 ft. from the ground. This allows the pseudostem to sag and the prop may be used to lower the bunch until it can be cut comfortably. If the plant has not been propped, a slanting cut is made half-way through the pseudostem at a suitable height. This allows the plant to sag sideways and the "tail" or flower end of the bunch may be caught and used to guide the bunch down until it can be cut easily. In either operation, two men should work together.

After cutting, the bunches are usually taken to every fourth row and placed on heaped leaves to reduce injury to the fruit. They are then carried to points from which they can be "wired" or otherwise carried to the packing shed.

Plate 10: **Plastic Bunch Covers Are Specially Manufactured for Covering Banana Bunches.** These are satisfactory when used on well-foliaged plants.

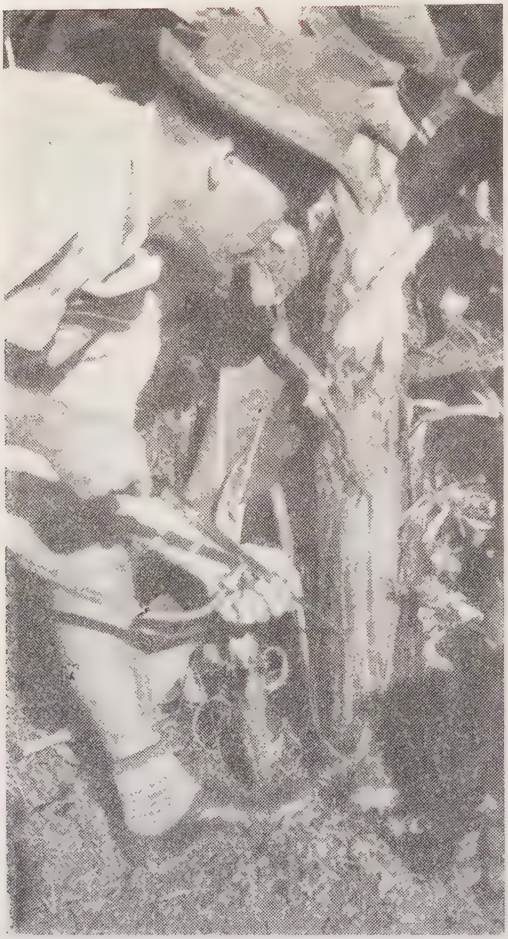


Plate 11: **Eradicating Bananas with Hormones.** The Diseases in Plants Acts prescribe that banana plantations must be eradicated at the end of their commercial life. The modern way is to inject the plant-killing hormone, 2,4–D, into the stem.

Wire Transport

Various aerial wire systems are in use, ranging from a single wire stretched from a stump within the plantation to another stump near the packing shed, along which run loose pulleys bearing short rope slings by which the bunch is suspended, to elaborate installations. Probably the best from the point of view of economy and mechanical efficiency is the "endless wire" system, in which the fruit is despatched from one or more centrally situated points in the plantation on carrier pulleys which run on wires to the packing shed. Each pulley with a bunch attached runs on a fixed wire but is roped to an endless wire running round grooved wheels at each end of the system. When the bunch is off-loaded at the packing shed the pulley is transferred to a second fixed wire, hitched to the endless wire and returned to the plantation for reloading.

The system is not difficult to install, but it must be strongly built. Having selected the centrally placed point or points for despatching the fruit, a suitable site is chosen near the packing shed for a receiving station. This should be on a small rise if possible, to give the wires greater height. It is usually an advantage to build a staging at each despatch point to facilitate handling and loading of the fruit on steep slopes. If these loading points are kept in a fairly straight line the upper end of the wiring system can be fixed at a point higher up the hill and the wires run straight to the packing shed so that they pass directly over each of the lower stagings.

Packing

While the packing shed need not be an elaborate and expensive structure, it should be built in such a way that the fruit can be handled and packed in comfort under hygienic conditions. The framework may consist of bush timber and the sides of slabs, but a good roof and a sound floor are essential.

As the bunches arrive at the packing shed, they may be stacked or immediately de-handed and allowed to "sweat". It is usual to pack the fruit the day after it has been cut. After each consignment has been despatched, all damaged and waste fruit, together with any refuse, should be cleared away and dumped some distance from the shed.

The fruit is marketed in the bunch or in 21 in. x 12 in. x 12 in. cases. The latter may contain single, full hand, or cluster packs. Size grades for single packs are: Small (not less than 5 in. long), 6's, 7's, 8's and 9's. Size grades for full hand and cluster packs are: small (5's), standard (6-7½ in.) and large (more than 7½ in.).

Eradication of Bananas

Until recently, most non-commercial plantations were dug out by hand, although cattle were sometimes used for eradicating bananas in the more accessible areas. Since the introduction of synthetic plant growth substances such as 2,4-D and MCPA for the control of broad-leaved weeds, these materials have been used for eradicating old banana plantations.

Plate 12: **Harvesting the Fruit.** Bunches may exceed 100 lb. or more at harvesting. They may be marketed in the bunch or dehanded to facilitate packing in standard single cases.

A 1 per cent. solution injected into the heart of the plant followed by spraying of any regrowth suckers with an 0·2 per cent. solution is quite effective. The commercial preparation is diluted with water to the required 1 per cent. strength of the active hormone and the solution is then injected at the rate of 15 c.c. (about ½ fl. oz.) for a fully grown plant, 10 c.c. (about ⅓ fl. oz.) for medium-sized plants, and 5 c.c. (about ⅙ fl. oz.) for small suckers.

Probably the most efficient and economical injector is built up from a small regulated jet sprayer in which the spray nozzle is replaced by a metal needle 8 in. long and sharply pointed, with a small hole just behind the point to allow the liquid to escape. A metal or rubber knapsack container is carried on the back and connected to the intake of the pump by rubber tubing. The sprayer is fitted with a graduated plunger rod and the dosage injected can therefore be regulated accurately. If the regulator is set to 5 c.c., the dosage for large, medium and small plants can be delivered accordingly as the pump is given three, two or one strokes. The needle is plunged into the base of the pseudostem about 12 in. above ground level and at an angle of about 45 degrees. It is then withdrawn about an inch and the requisite amount of solution pumped in.

The quantity of solution required for eradication will depend on the condition of the plantation, but as a general rule, unless the area is in an exceedingly overgrown condition, 5 gal. of a 1 per cent. solution should be sufficient to inject an acre planted on a 9 ft. x 9 ft. spacing. The quantity of the commercial preparation required may be calculated from this once the concentration of actual hormone in it is known.

Suckers which develop from the corms of injected plants should be allowed to grow until they have developed broad adult leaves and then sprayed with a 0·2 per cent. solution of the original material—that is, one-fifth of the concentration used for the primary injection. A second spray treatment may be required a little later to complete the eradication, but this is on the basis of isolated spot applications only.

Plate 13: **Cyclone Damage to Bananas.** Cyclonic winds are recognised as a hazard in most banana areas. This photograph was taken at the Ayr Regional Experiment Station after a cyclone in February, 1959.

Beware of Loose Seed-Beds When Sowing Irrigated Pastures!

The uneven establishment of the irrigated pasture shown in Plate 1 was directly responsible for the abandonment of the project.

The pasture was machine-sown and the area was uniformly covered with both seed and fertilizer. The seed-bed was soft and spongy. Germination over the whole area was fair. The sparsely covered strips show the poor establishment on the ground which passed between the wheels of the tractors. The grassy strips were pressed by the wheels of the tractor and by the wheels of the planter.

The pressed strips grew particularly well but the pasture's performance on the unpressed strips was most disappointing.

Eventually, in disgust, the grower ploughed out the pasture as he found that the returns could not equal the cost of irrigation.

Loose seed-beds dry out too quickly and contain air spaces which limit the root development of the plants. The problem is accentuated with pastures as most species have a shallow root system in the early stages of growth.

Don't allow faulty seed-bed preparation to limit the success of your pastures. Prepare a satisfactory seed-bed—one that is well-worked, fine, firm, weed-free, moist and fertile. Adjust fineness in accordance with the requirements of your particular soil type.

—N.W.D., Gympie.

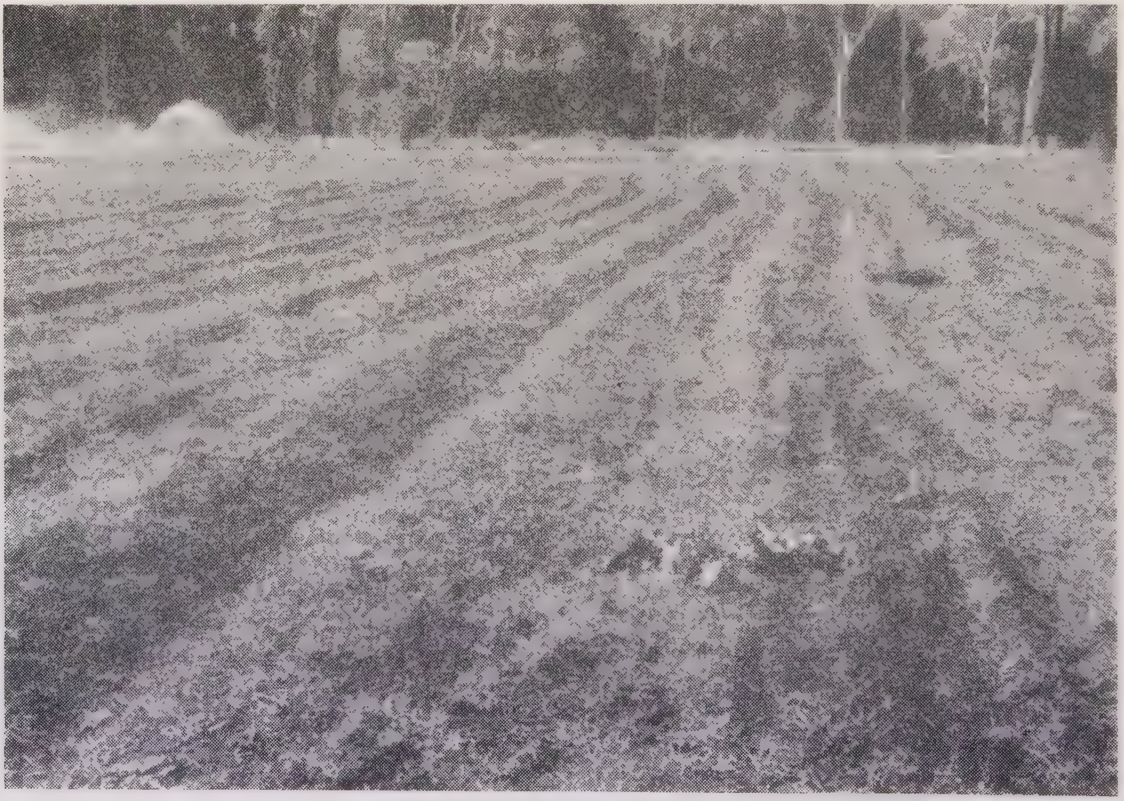


Plate 1

Irrigated Pasture Showing Uneven Establishment Due to a Soft and Spongy Seed-bed.

The Johns Leveller

By **L. E. BRANDS, Adviser in Agriculture.**

The place of the Johns Leveller is not confined to irrigation farms only, as it can be used to level off any type of country from "melon-holey" to the slightly uneven. The levelling action provides two-fold results, namely a more even water distribution and also an improved moisture connection of subsoil and top soil. A third and not less important gain is the more uniform sowing depth.

The Johns leveller is made of two 12 in. x 3 in. hardwood planks 12 to 16 ft. long, fastened at right angles. The horizontal board acts as a means of control, while the vertical board, to the bottom of which is fastened a steel plate 3 in. x ½ in. for a cutting edge, acts as a grader blade.

A handle is attached to the middle of the bottom board, and by raising or lowering the handle, the leveller can be made to gather or spread soil as required.

A chain is attached for pulling the leveller, and with the use of a kidney link, the pull on the chain can be adjusted to enable the leveller to be pulled obliquely or angled.

The usefulness of the Johns leveller has already been demonstrated on many farms in Queensland, excellent work being performed where the soil is in a dry, fine tilth.

To lessen manual labour; power-lift attachments could be adapted, as illustrated in Plate 2. Plate 1 shows the direct three-point linkage.

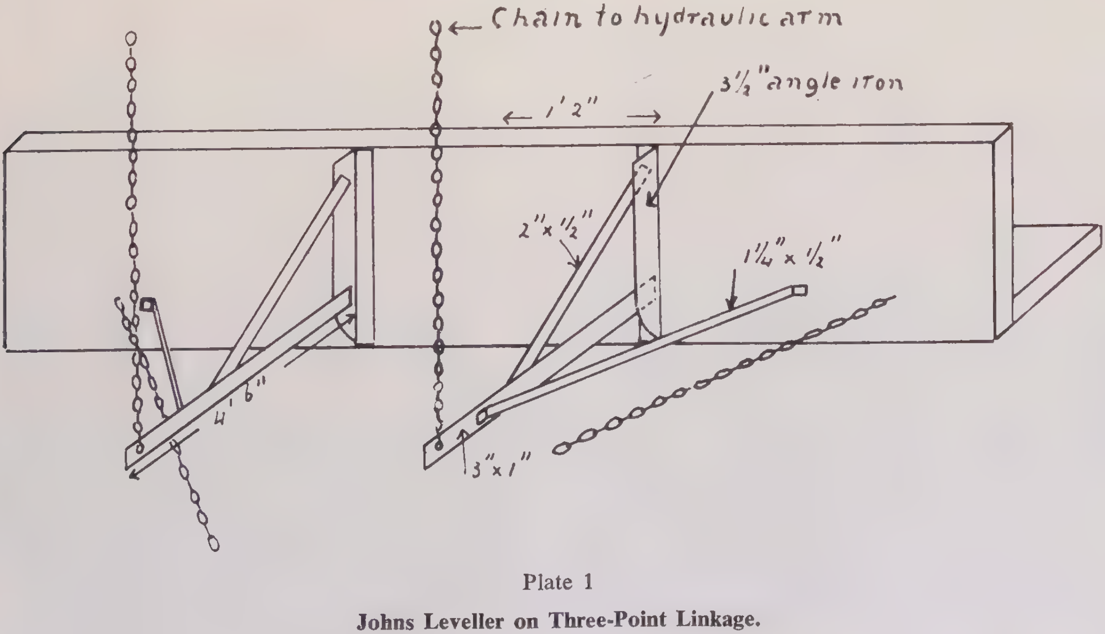


Plate 1

Johns Leveller on Three-Point Linkage.

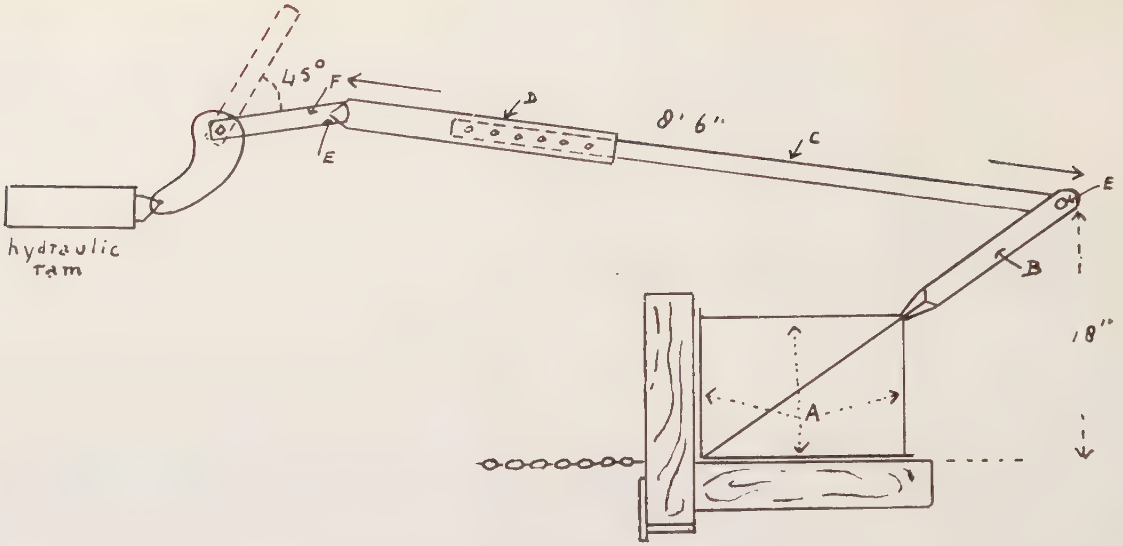


Plate 2

Power Lift Attachment to Johns Leveller.

A 1½ in. × ½ in. flat iron.

B 2 in. × ½ in. flat iron with a 90-deg. twist at supports of A.

C 1½ in. piping
D 2 in. piping } C fits into D and with a series of holes in C, the length of the two can be adjusted.

E discarded motor car steering knuckles, fitting in holes ¾ in. tapered to ⅝ in. in a depth of ½ in., ½ in. thread—standard for A70 Austin car or larger.

F 2½ in. × ½ in. flat iron, 2 arms, one from each side, meeting at back, ribbed where necessary for lateral strength by 1 in. × ½ in. flat iron welded on.

Is A Wheat Variety Equally Suitable For All Districts?

Part of the work of a regional experiment station is to test the relative value of varieties of various crops for the region in which the Station is situated.

At Biloela, the Regional Station carries out varietal trials with wheat each year and it has been found that whilst the reaction of some varieties is much the same in the Callide Valley as 300 miles south on the Darling Downs, others are either better or worse. The main reason for these differences is thought to be the climate, particularly in regard to temperature and length of day.

Some examples of varietal reaction are:

(1) Varieties such as *Lawrence* and *Celebration* have yielded poorly in trials on the Station, though Lawrence is highly thought of in parts of the Downs. The recently released Queensland bred variety, *Gala,* has not performed well at Biloela. In fact, *no slow-maturing variety has shown promise in the Station's trials.*

(2) *Saga,* a N.S.W. bred variety which is practically unknown on the Downs, yields very well on the Experiment Station's alluvial soil in dry seasons. Unfortunately it is susceptible to rust.

(3) *Spica* and *Festival,* although quite good, do not seem to yield so well as they do farther south. The new rust resistant variety *Kenora* is promising.

In general, trials at the Regional Experiment Station over a number of years have indicated that in the Callide Valley it is best to *plant quick maturing rust resistant varieties such as Spica and Kenora early in the season* that is in May if possible. These results have been confirmed by the success of local farmers who have followed this practice.

—*J. G. J. STEVENS,*

Beef Gains From Irrigated Pastures In The Burdekin Delta

By G. H. ALLEN, Senior Agronomist, and
W. A. R. COWDRY, Senior Experimentalist.

Experiments have shown that irrigated tropical pastures in the Burdekin delta can increase stocking rates from 1 beast to 10 acres to 1 beast to two-thirds of an acre, and that a liveweight gain of 400 to 450 lb. per acre can be expected in a fattening period of 300 days.

The establishment and production of irrigated tropical grass and legume pasture mixtures have been studied at the Ayr Regional Experiment Station since 1950 to determine the potentialities of the species and their value for beef fattening.

The principal pastures were (*a*) para grass and centro (*b*) guinea grass and centro (*c*) guinea grass and stylo and (*d*) Rhodes grass and stylo. The pastures were irrigated fortnightly. This required between 2·3 and 3 in. per irrigation in periods when rainfall had not supplied these amounts.

By using a randomised block layout of four paddocks for each of the mixtures, rotational use of 1 week grazing and 3 weeks spelling was practised. The four paddocks of each mixture had a total area of 5 acres.

During the period, eight groups of steers were grazed and fattened on these pastures.

A synopsis of the data from these livestock studies is set out in Table 1.

TABLE 1

Lot No.	Number and Type	Commencement		Finish		No. of Days Covered	Average Live-weight gain (lb.) per beast	Total gain per acre (lb.)	Average gain (lb.) per beast per day	Average Stocking rate (beasts/acre)	Average gain (lb.) per acre per day
		Date	Average Weight (lb.)	Date	Average Weight (lb.)						
1	18 steers . .	30–8–50	836	15–7–51	1,144	320	308	184	0·96	0·60	0·58
2	24 steers . .	18–9–51	641	19–8–52	1,017	336	376	290	1·12	0·77	0·86
3	33 steers . .	9–9–52	718	19–8–53	1,067	344	349	445	1·01	1·28	1·29
4	46 steers . .	29–9–53	770	29–6–54	992	273	222	420	0·81	1·86	1·54
5	70 yearlings (6)	17–8–54	500	7–5–55	747	263	247	525	0·94	2·10	2·00
	(10)			30–6–55	834	286	334	669	1·17	2·00	2·34
	(21)			17–5–56	1,250	608	750	1,204	1·23	1·61	1·98
	(33)			2–8–56	1,117	685	617	974	0·90	1·58	1·42
6	32 steers . .	13–11–56	949	23–4–57	1,100	161	161	221	1·00	1·37	1·37
7	30 steers* . .	20–5–57	490	21–5–58	894	366	404	616	1·10	1·53	1·68
8	20 steers† . .	12–12–57	466	17–9–58	974	279	508	750	1·82	1·48	2·69

* Data from 15 steers.
† Data from 8 steers.

FOOTNOTE

Para grass (*Brachiaria mutica*), Guinea grass (*Panicum maximum*), Rhodes grass (*Chloris gayana*), centro (*Centrosema pubescens*), stylo (*Stylosanthes gracilis*).

Plate 1

Group of Steers Grazing Para and Centro Plot.

Monthly Rate of Gain per Beast

Under tropical conditions there are marked variations in pasture production and in liveweight gains of cattle grazing them. Climatic effects are also important, especially those periods of high humidity and high temperature during January and February when liveweight gains decline under climatic stress even when ample high quality grazing is available.

The average monthly liveweight gains per beast on each of the four pasture mixtures are shown in Plate 2. It will be noted that Rhodes grass and stylo are prominent during the short winter period whereas the more vigorous tropical grasses give peak gains during the early summer.

Rate of Grazing

Grazing rate was maintained at safe levels to ensure good pasture management. In some years, insufficient animals were available at times to use the pastures completely.

The average monthly stocking rate of each of the four pasture mixtures is set out in Plate 3. Most of the cattle were 2-year-olds when purchased but there was one lot of yearlings.

The graph demonstrates the overall supremacy of the two mixtures which included centro, as well as the fact that the Rhodes and stylo were able to support a greater number of cattle during July-August-September.

The data on stocking rates have also been calculated on an annual basis (July to June) for each pasture mixture over six consecutive seasons.

Weight Gains per Acre

The weight gain per beast is related to stocking rate and because the practical value of this work depends upon the production of beef per acre, data on this aspect have been presented in

TABLE 2

Average Stocking Rate (Beasts per Acre)

Pasture Mixture	1952–53	1953–54	1954–55	1955–56	1956–67	1957–58	Average
Rhodes and Stylo	1·22	1·72	1·98	1·18	1·24	1·57	1·49
Para and Centro	1·52	1·92	2·16	1·20	1·46	1·50	1·63
Guinea and Centro	1·26	1·98	2·04	1·20	1·52	1·57	1·60
Guinea and Stylo	1·26	1·88	1·70	1·12	1·29	1·51	1·46
Average	1·32	1·88	1·97	1·18	1·38	1·54	1·54

Plate 4. This shows the average monthly liveweight gains per acre. It will be noted that the high gains are obtained in the warmer months with peaks in spring and late summer. Climatic effects are responsible for lowered gains from January to March when grazing habits are influenced by high temperatures and high humidity. The low weight increases in the winter months result from slower pasture production and the lower nutrient values obtained from the tropical species during the cool season.

Seasonal variations occur in pasture production. Liveweight gains also vary with each group of cattle. Liveweight gains per acre for the four pasture mixtures are presented for complete years in Table 3.

TABLE 3

Cattle Liveweight Gains per Acre (lb. per day)

Pasture Mixture	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58	Average
Rhodes and Stylo	1·39	1·45	1·36	1·14	1·02	1·65	1·33
Para and Centro	1·35	1·30	2·23	1·55	1·32	1·95	1·62
Guinea and Centro	1·17	1·57	2·20	1·09	1·13	1·86	1·50
Guinea and Stylo	1·32	1·84	1·62	1·14	0·96	1·60	1·41
Average	1·31	1·54	1·85	1·23	1·11	1·76	1·47

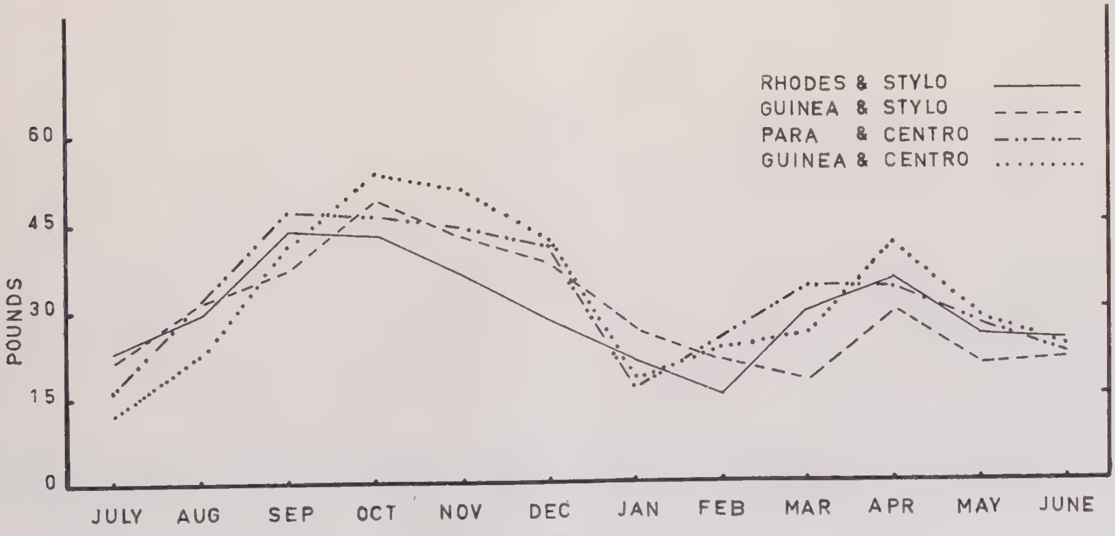


Plate 2

Average Monthly Liveweight Gains Per Beast on Irrigated Pastures at Ayr Regional Experiment Station.

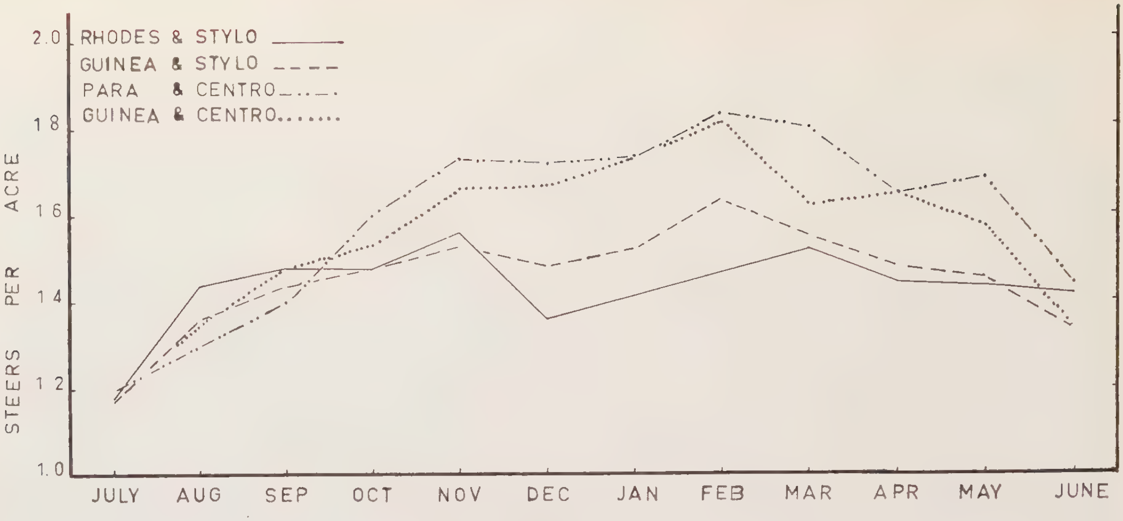


Plate 3

Average Monthly Stocking Rate Per Acre.

It is not intended here that we discuss the economics of beef fattening in the tropics. Annual variations in availability and costs of store cattle, irregular killing seasons at coastal meatworks, the requirements of the operator and the circumstances on individual properties are factors which influence cattle fattening projects.

The data presented do indicate, however, what weight gains can be obtained from highly productive irrigated pasture and the seasonal stocking rates which were maintained. The liveweight increase per acre during the year would allow some assessment of potential cash value for the season in which cattle would be topped off.

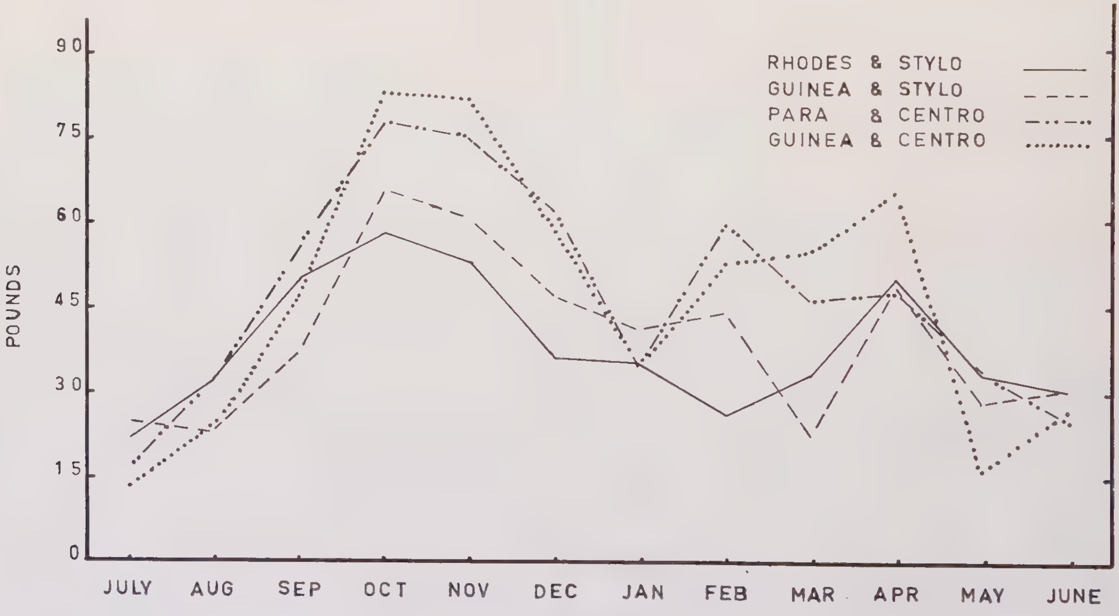


Plate 4

Average Monthly Liveweight Gains Per Acre.

The pastures containing guinea grass and para grass are still highly productive and although centro is still very active more recent studies have shown that the legume *Glycine javanica* may be almost as productive in summer yet supply more palatable and more nutritious grazing. Glycine will grow well into the cool weather and it also responds more quickly after a winter check or frost damage.

The majority of the stock fattened were graded as export quality carcasses or first grade local market beef. Changes in beef prices and gradings are of such magnitude that a profit or loss analysis on such projects could not be prepared with workable accuracy.

The Burdekin Valley is a potential area for major irrigation developments and this undeveloped region and adjacent grazing lands carry approximately 1 beast to 10 acres on the better country and only 1 beast to 25 acres in more inland areas. It has been shown that irrigated pastures will support and fatten 1½ beasts per acre and that a liveweight gain of 400 to 450 lb. can be expected per acre in a fattening period of 300 days.

[*See next month's Journal for "Yields From Irrigated Pastures in The Burdekin".*]

⁂

Stylo Seed Harvesting

The legume Stylo (*Stylosanthes gracilis*) matures over an extended period so that some loss of seed is unavoidable due to immaturity or shedding when being harvested mechanically.

Seed setting is prolific, and yields varying from 70 to 200 lb. per acre have been obtained over a number of years at the Regional Experiment Station in the Burdekin District.

Normally this crop is mown before the seed is machine harvested, but trials have indicated that under the dry climatic conditions prevailing in this area during August-September, it is possible to harvest this crop direct in the one operation.

Under growing conditions ensuring ample moisture from rainfall with supplementary irrigation, the hairy seedheads are covered with a sticky substance which hampers effective thrashing. This condition may be overcome, however, by discontinuing irrigation at the end of the flowering period. Seed losses can be thereby reduced, the result by this method of moisture stress being comparable with that obtained when the crop is allowed to dry in the field after mowing.

Harvesting at the Burdekin Station was carried out with an all-crop harvester equipped with a peg-type threshing cylinder, a high cylinder speed being used in combination with a full set of concaves. The comb was set at approximately 8 to 10 in. below the top of the sward.

Stylo flowers mainly on the outside of the plant and in even stands very little seed is lost by cutting at this height.

A second cutting carried out a few days afterwards, using a lower comb setting, yielded worthwhile quantities of seed, especially when weather conditions had prevented proper drying out.

Harvesting of all available seed is thus ensured and the residue of the first cut is rethreshed, after a curing period, during which some maturation of unripe seeds takes place.

The seed sample obtained should require only light cleaning, for which an air-blast cleaner has been found quite satisfactory. A high percentage of the paler-coloured seed will be found to have normal viability.

—W. A. R. COWDRY, Senior Experimentalist,
and G. VERHOEVEN, Experimentalist.

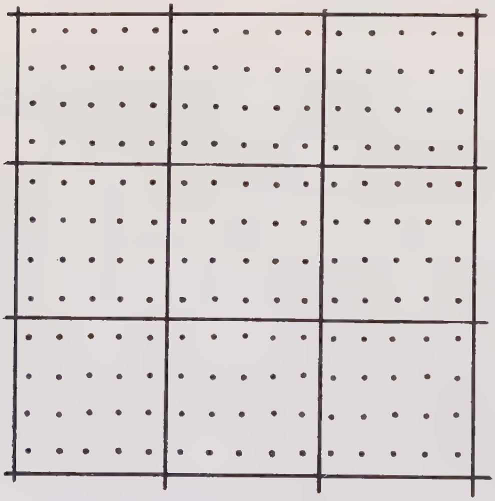
Way To Estimate Acreage

By E. SYPKENS, Soil Conservation Section.

For reasons of sound management you'll sometimes want to know the exact acreages of the various paddocks on your farm. When they are square, trapezoidal or diamond-shaped this won't give much trouble. To measure irregularly-shaped areas as are often found on contoured land a simple method has been developed for use in conjunction with soil conservation farm plans as prepared by the Soil Conservation Service of the Department of Agriculture and Stock. The method is also suited for use on aerial photographs and parish maps, if required.

It is, as you will see illustrated, a grid with a known number of evenly spaced dots—20 in this case—to the sq. in. On a standard soil conservation of 10 ch. to the in., each sq. in. represents and area of 100 sq. ch., or 10 ac. Each dot of a 20-dot grid used on such a plan, will therefore represent $\frac{10}{20}$ or 0·5 ac.

You can draw this dot grid on transparent paper, place it over the area on your map and count the dots that are within the boundaries of the area to be measured. The number of the dots you count, multiplied by 0·5, will give you the correct acreage to the nearest half acre.



1 dot is 0.5 acres on map of 1 in. = 10 ch.

By increasing the number of dots to the sq. in. you will get more exact results. But don't forget that when you have 40 dots to the sq. in., each dot represents 0·25 ac. instead of 0·5 ac. when you use your dot grid on a map of 10 ch. to the in.

If you don't have a plan but are in possession of aerial photographs of your property, you can use the dot grid method also in conjunction with these. For reasons of accuracy, however, you'll have to increase the number of dots per sq. in. in accordance with the scale of your photographs.

If you obtained these from the Survey Office of the Land's Department they have most likely been taken from a height of 13,000 ft. and are on a scale of approximately 30 ch. to the in.

On these photographs a grid of 40 dots to the sq. in. would give you the results you are aiming for, if you remember that one dot represents in this case: $\frac{30\times30}{10\times40} = 2{\cdot}25$ ac.

If you are in doubt as to the scale of your aerial photographs all you have to do is to measure off a length of road in chains on the ground and compare this with the same distance measured in inches on your photograph.

The method of measuring areas with a dot grid has been tested against the results obtained with a planimeter, a precision instrument for measuring area. It was found that the dot grid method compared favourably with the planimeter.

Immunizing And Inoculating Cattle Against Tick Fever

By A. L. CLAY, Director, Division of Animal Industry.

During the last two or three years, several important additions have been made to our knowledge of the tick fevers of cattle. For some 15 or more years prior to that, little or no research was in progress on these diseases. This was due in part to World War II and also to a mistaken idea that the problem of immunizing cattle against tick fever had been solved or at all events reduced to the point where it was no longer of any great consequence. Time has demonstrated that the problem is still with us to a significant degree and this has been emphasized by much increased values for cattle.

When immunization against tick fever fails to give adequate protection and animals die, it is a matter of much more moment today than ever before. Such failures are almost certainly no more common (and possibly are less common) today than previously but they attract more attention because of financial considerations.

The after-care of cattle that have been immunized is of great importance in keeping losses down to a minimum. It has to be realised that in immunizing cattle against tick fever they are actually given the disease. In this respect there is an important difference between immunization and most vaccinations. Vaccinations set up a resistance without actually giving the animal the disease concerned.

Immunization against tick fever can be and often is a serious debilitating influence as a result of the anaemia that occurs. Immunized cattle should be regarded as being below par for some 6 to 8 weeks after going through their reaction. During this period they should be well looked after, put on good feed and water, provided with adequate shade, and not knocked about in the process of driving or yarding.

Although early exposure to ticks is very desirable in order to reinforce the immunity conferred by blood inoculation, the degree of infestation must be kept under firm control. Remember that you are dealing with a debilitated animal and moreover, very frequently, one that has never been exposed to ticks before. Special care is called for in the case of cattle with a long coat as they can, if never previously tick-infested, become heavily infested in a short time without much outward sign—until it is too late to help them. Death in these cases is more likely to be due to the sudden massive invasion by the ticks themselves than to tick fever.

If in doubt about the degree of tick infestation to allow, consult your local veterinary surgeon or inspector of stock. Delay may be dangerous.

Plate 1

Laboratory Worker Drawing Blood from Tick Fever "Bleeder".

The following notes relating to the Department's immunization service at Yeerongpilly and Oonoonba, and the inoculation of cattle "on the property," have been compiled by staff of the Division of Animal Industry with an extensive knowledge of the problems involved. These notes represent what may fairly be stated to be the best available advice in the present state of our knowledge and are commended to all interested cattle owners for careful consideration. Further notes will be issued as and when the acquiring of new knowledge makes it desirable to do so.

IMMUNIZING SERVICE

1. The demand for tick fever immunization is such that it may be necessary, owing to shortage of accommodation and facilities, to restrict admission to stud animals.

2. Animals may be consigned by rail or delivered by road to Yeerongpilly or Oonoonba. All associated charges must be prepaid. Cattle consigned "freight to pay" may not be accepted.

3. Cattle for destinations south of Townsville will be immunized at Yeerongpilly; for north and west of that centre, they must be sent to Oonoonba.

4. Arrangements should be made with a Stock and Station Agent to handle freight charges, booking of wagons, etc.

5. All cattle are to be free from disease, ticks and other parasites.

6. The laboratory should be advised if any animals have been previously inoculated for tick fever and/or if they have been exposed to tick infestation.

7. The period required for immunization varies, but is usually 4 to 6 weeks.

8. The charge is 9s. a head per day for all animals, including calves. This charge may be varied from time to time.

9. Additional services such as inoculation for pleuropneumonia, blackleg, or testing for tuberculosis, brucellosis, leptospirosis, etc., may be carried out on request. Charges for such work are not included in the figure shown in Item 8.

10. Immunization against the two common forms of tick fever is normally undertaken, but cattle that are going to areas where anaplasmosis is known to occur will be immunized against this form also, on request.

11. The immunization process confers a substantial degree of immunity which, however, is not absolute. In duration, the immunity varies from about 2 months in some to 6 months or longer in the majority of animals.

12. Continuing immunity is dependent upon subsequent exposure to infective ticks. It is recommended therefore, that the cattle be permitted to acquire *light to moderate* tick burdens as soon as possible. Owners are warned that cattle not previously subjected to tick infestation are highly susceptible to tick worry. If the coat is long, gross burdens may be picked up before being detected.

13. The owner or his agent will be advised when the animals are ready to be sent home. Cattle should not be taken away from the laboratory until they have recovered from their reactions. Severe stress, such as a long journey or change of conditions, may cause a relapse. The Department does not accept any responsibility for any untoward happening to animals, either during loading, in transit or subsequent to arrival at their destination.

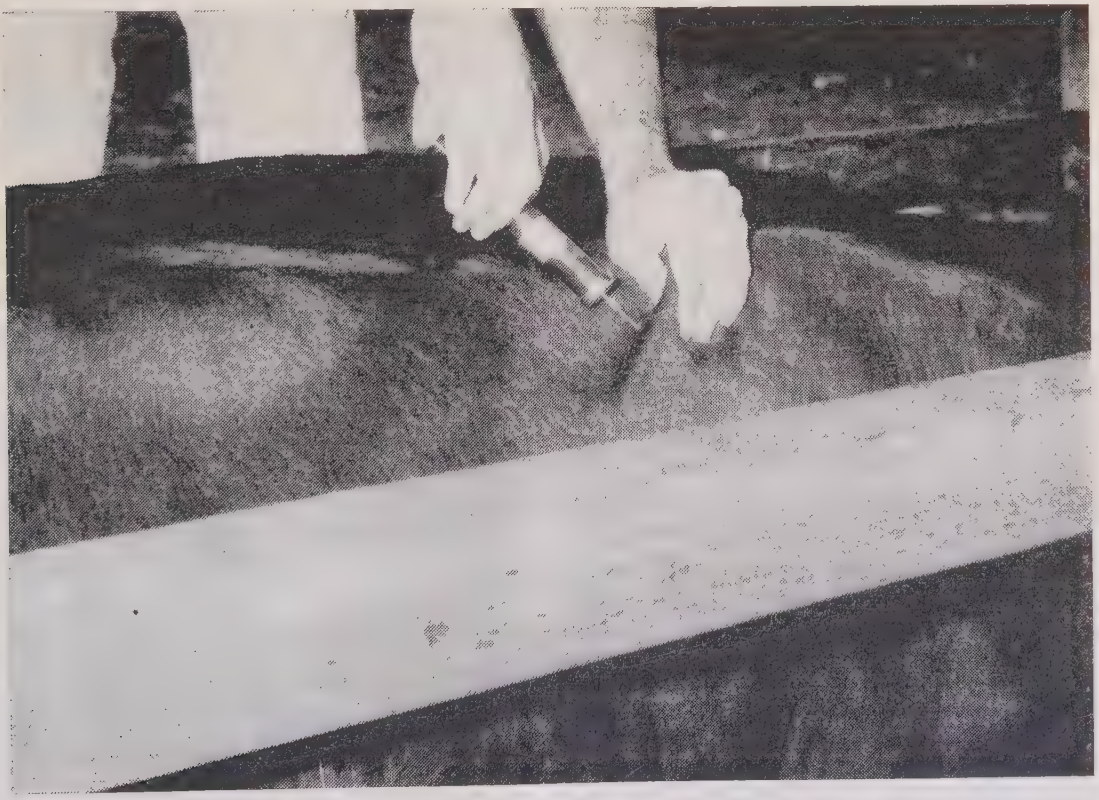


Plate 2

Inoculating Against Tick Fever. The injection is usually made in the loose skin behind the shoulder.

Plate 3

Laboratory Worker Examining Blood Smears for the Presence of Tick Fever Organisms.

14. The following procedure is suggested when cattle arrive home:

(*a*) Keep them in small, shady paddocks close to the homestead for 6 weeks. They should be exposed to ticks.

(*b*) Inspect them daily. Long-coated cattle should be watched closely for tick infestation as they may become heavily infested without this being apparent.

(*c*) Should sickness be evident, consult the nearest veterinarian or stock inspector.

(*d*) If there are symptoms of tick fever such as morning temperature of 105 deg. F. or higher, and/or passage of redwater, treat with one of the tick fever drugs—acaprin, pirovan, piroparv, babesan or ludobal—in accordance with the manufacturer's directions. It should be kept in mind that diseases other than tick fever may cause similar symptoms. These will not respond to the drugs mentioned.

(*e*) Animals yarded for inspection should be driven quietly. If excited or hot from exercise, allow to cool down before injecting the tick fever drugs, as these are more toxic in distressed animals.

(*f*) Take temperatures of sick animals daily, preferably in the morning. If the temperature is still over 105 deg. F. on the day following treatment, a second dose may be required. Failure to respond, however, may indicate that some other disease is present.

15. Keep the following on hand:

Two clinical thermometers (stubby bulb).

Two syringes, Record type, 10 c.c.

One box hypodermic needles, 18G. x 1½ in. Record fitting.

Sufficient drugs to treat every animal at least once.

16. All possible care is taken with the animals during their stay at the laboratory but no responsibility is taken by the Department for sickness or deaths arising out of the immunization process or otherwise.

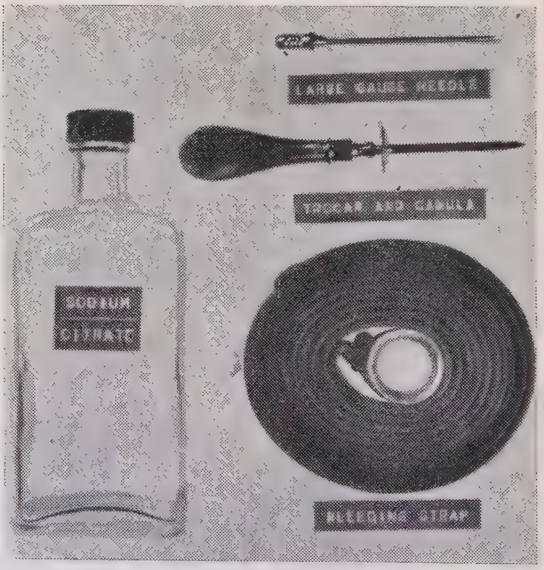


Plate 4

Equipment Used in Drawing Blood for Inoculation.

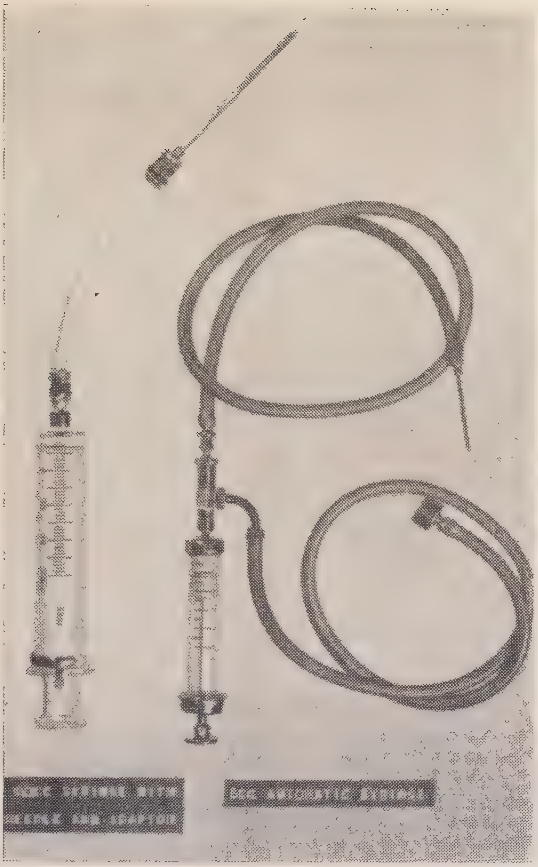


Plate 5

Inoculation Equipment.

17. The Department reserves the right at all times to obtain additional veterinary opinion, the cost to be borne by the owner. The owner may also engage his own veterinary surgeon to examine and treat animals at the owner's expense, provided that due notice is given to the Director of the Laboratory at which the animals are located.

INOCULATING CATTLE FOR TICK FEVER

For those stockowners wishing to inoculate their own cattle for tick fever, the following information is given:

1. Blood vaccine for tick fever inoculation may be supplied direct from the laboratories at Yeerongpilly and Oonoonba, or a "bleeder" may be purchased and blood drawn as required. (For directions for collection of blood, see Divisional Advisory Leaflet No. 131).

2. Blood vaccine contains *Babesia bigemina* and *Babesia argentina*, the two organisms which cause tick fever. A third organism, *Anaplasma centrale,* is included at the owner's request for areas where anaplasmosis occurs.

3. Blood should be used as soon after bleeding as possible. Should delay in using be unavoidable, store it in a refrigerator, but do not freeze. If in doubt about its use, contact the laboratory.

4. The dose is 5 c.c. injected beneath the skin in front of or behind the shoulder, using a hypodermic syringe and needle. All instruments should be boiled for 10 min. and cooled before use.

5. Inoculation is intended to produce infection and very severe reactions may occur to *B. bigemin A.* and *B. argentina.* Reactions to *A. centrale* are usually mild and no treatment is required to control them.

6. The reaction usually starts between the seventh and fourteenth day, though it may begin earlier or later than these times.

7. Severe reactions should be treated with drugs such as acaprin, piroparv, pirovan, babesan or ludobal. Drugs should be used as directed by the manufacturer.

Indications for their use are when an early morning temperature is over 105 deg. F. and/or the beast is obviously sick. A second dose may be given but not sooner than 8 hours after the first. These drugs are not effective against anaplasmosis. Sufficient drugs should be available to treat every animal if necessary. It is emphasized that the animals must be watched closely so that treatment can be applied early. They should be moved quietly before and after treatment because the drugs are more toxic in excited or overheated animals.

8. Immunity to tick fever depends on the persistence of infection in the animal after recovery from the reaction. The immunity may last only a few months and it is important that the cattle become moderately tick infested soon after the reaction in order to maintain the immunity.

9. Re-inoculation is desirable if reactions to the first inoculation are mild or absent, particularly when the cattle have not been exposed to tick fever previously, or when their immunity is in any way suspect. Also, if they have had heavy treatment with drugs to control severe reactions, re-inoculation should be considered.

10. Pregnant cows are likely to abort if the reaction following inoculation is severe. Therefore, if it is necessary to inoculate these animals, extra care is necessary in taking temperatures and applying treatment early.

11. As a general rule, cattle should be kept quietly on their pastures and not shifted until 4 to 6 weeks after their reaction.

12. Relapses may occur and are likely to be severe when resistance is lowered by hard driving, long railway journeys or any other stresses of this nature. However, other forms of sickness may be brought on under these circumstances and care must be taken to differentiate between them and tick fever.

13. Owners should contact their local veterinarian or stock inspector when assistance is needed.

14. Orders for blood should be placed 48 hours before the requested time of despatch.

15. Blood vaccine is prepared carefully, making use of the most recently available knowledge. The degree to which inoculated animals react and/or the actual time of onset of reaction cannot be predicted with certainty. Therefore, no responsibility is taken by the Department for losses that may occur either from reactions to inoculation or through failure of animals to react.

⁂

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Weldrite Spark Arresters Tested

Formal tests on spark arresters are conducted by The Tractor Testing Committee at the Testing Station, Werribee, on behalf of those Companies concerned with tractors, engines, or spark arresters, who wish to have these equipments tested. The arrester is tested on the engine for which it is especially designed, or if this is not convenient, it is tested on an engine having the characteristics and power for which it is intended.*

40 H.P. Model

Name and Type: Weldrite (40 h.p.).

Submitted by: Weldrite Engineering Pty. Ltd., Spotswood, Victoria.

For Particular Engine: Not nominated.

Operating Principle: Screen.

Declared Maximum Horse-power: 40.

Dimensions: Exhaust pipe, diameter 1¾ in. Tail pipe, none. Arrester, outside diameter 4½ in., length 6 in., weight 3 lb.

Materials: End caps—16g. M.S.; Screens—30/32g. "Monel" on 18g. perforated M.S.

Mounting: Vertical.

Details of Test Engine: Fordson Major Diesel Tractor; 4 cyl.; 220 cu. in.; 38-belt horse-power maximum; rated speed 1,600 r.p.m.

Summary of Test Results

(*a*) *Effectiveness of Spark Arresting:*

Particles injected at rate of 100 gm. in 15 min.

Particle Size	Engine Load Condition	Carbon Passing Arrester (Percentage)	Remarks
Large	High ..	Nil	Two tests
Large	Low ..	Nil	Two tests
Small	High ..	0·1	Average of two tests
Small	Low ..	0·6	Average of two tests

(*b*) *Back Pressure:* At high load 7 in. water.

(*c*) *Temperatures:* Air—52 deg. F. approx. Body of Arrester approx. 700 deg. F.

(*d*) *Noise Levels:* Not taken.

Comments

(*a*) *Cleaning:* The arrester provides no storage space for trapped material, which therefore falls back into the exhaust as soon as the engine is turned off.

(*b*) *Assembly:* The assembly is held together with three ¼ in. M.S. bolts and nuts which become jammed with heating; one of these was broken while dismantling for cleaning during the test. Brass wing nuts would be preferable.

(*c*) *Life:* The life of the "Monel" wire gauze itself should be quite satisfactory; however, the comparatively light gauge perforated sheet iron on which it is mounted would tend to rust and burn out rapidly, and may not last the 1,000 hours minimum required under the S.A.E. Code for an arrester readily dismantled for inspection. The screens are, however, removable; the makers recommend they be regularly inspected, and replaced as necessary.

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* The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders Lane, Melbourne.

(*d*) This report makes no promise about the likely performance of the arrester other than in the new condition in which it was supplied for test.

(*e*) It was pointed out to us that one of the purposes of the double screen of fine gauze was to provide for flame arresting. The effectiveness of the design for this purpose was not tested, and we are not able to say to what extent, if any, it would be so effective.

(*f*) The noise of the tractor exhaust appeared to be excessive with the arrester only fitted; the light screen construction offers little, if any, more muffling effect than an open pipe.

20 H.P. Model

Name: Weldrite (20 h.p. model).

Submitted by: Weldrite Engineering Pty. Ltd., Spotswood, Victoria.

For Particular Engine: Wisconsin VF4 petrol engine.

Brief Specification of Arrester

Operating Principle: Screen (includes integral muffler).

Declared Maximum Horse-power: 21.

Dimensions: Exhaust pipe, diam. 1¼ in. Tail pipe, none. Arrester outside diam. 4½ in., length 12 in., weight 8 lb.

Materials: Body, 16g. steel. Screens, 30/32g. "Monel" wire gauze on 18g. perforated mild steel.

Mounting: Vertical.

Details of Test Engine: Wisconsin VF4 petrol engine on welding unit. 4-cyl.; 21 h.p. maximum; 110 cu. in.; rated speed 2,000 r.p.m.

Summary of Test Results

(*a*) *Effectiveness of Spark Arresting:*

Particles injected at rate of 50 gm. in 10 min. (See comments (*a*).)

Particle Size	Engine Load Condition	Carbon Passing Arrester (Percentage)	Remarks
Large	High ..	Nil	Two tests
Large	Low ..	Nil	,,
Small	High ..	Nil	,,
Small	Low ..	Nil	,,

(*b*) *Back Pressure:* At high load 6 in. water.

(*c*) *Temperatures:* Air—60 deg. F. Body of arrester—750 deg. F. approx.

(*d*) *Noise Levels:* Not taken.

Comments

(*a*) The test engine was direct coupled to a Lincoln DC 250 amp. 30 volt welding unit. The "high load" tests were run with the welding output terminals short-circuited, requiring approximately the full output of the engine. To minimize the duty on the electrical system, runs were shortened by using 50 gm. samples of carbon injected over a period of 10 min., instead of the usual 100 gm. in 20 min.

(*b*) *Assembly:* The arrester supplied for test was assembled with self-threading screws holding the outer screen to the body and top cap. One of these broke off during the tests, and it seemed likely that this or other damage to the screens could occur in use, particularly during dismantling for cleaning. It is understood that these screws will be replaced in future by ¼-in. bolts joining the top cap to the body, so clamping the screens in place.

The effectiveness of spark arresting would be lost if for any reason a good fit was not provided and maintained between the outer screen and the body and top cap.

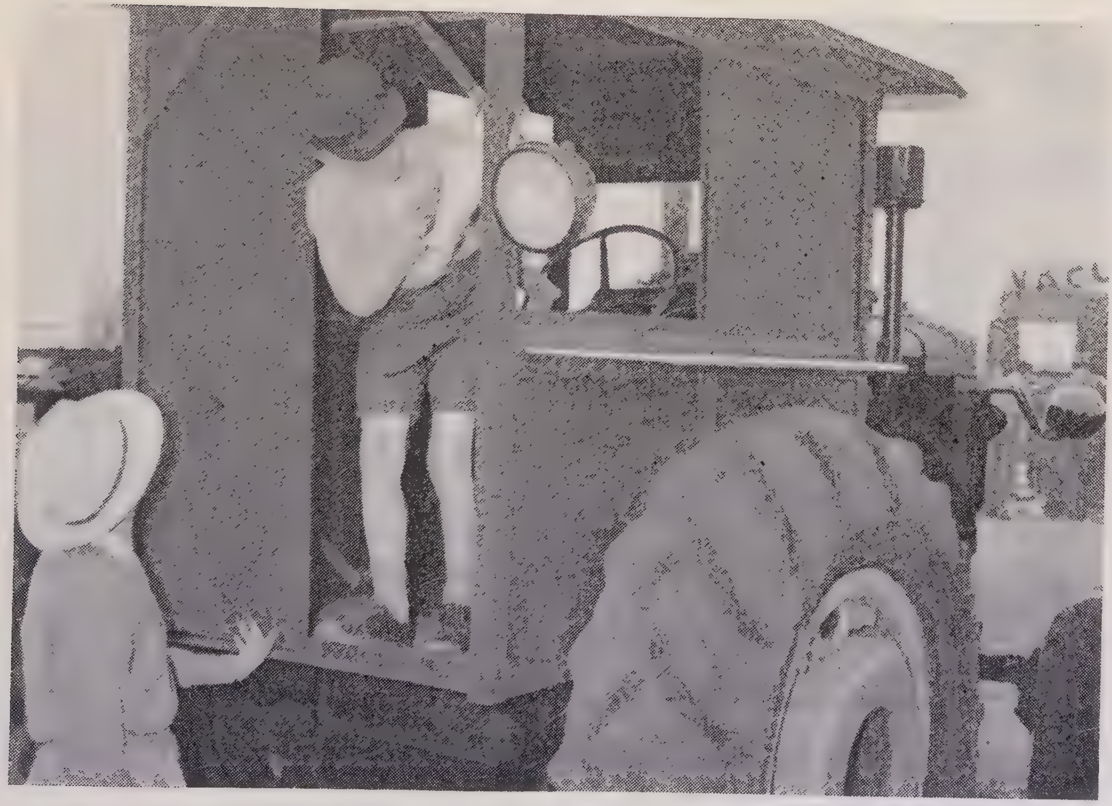
(*c*) *Life:* The life of the "Monel" gauze itself should be quite satisfactory; however, the comparatively light gauge perforated sheet iron on which it is mounted would tend to rust and burn out rapidly, and may not last the minimum 1,000 hr. required under the S.A.E. Code for an arrester readily dismantled for inspection. The screens are, however, removable; the makers recommend they be regularly inspected and replaced as necessary.

(*d*) This report makes no promise about the likely performance of the arrester other than in the new condition in which it was supplied for test.

(*e*) It was pointed out to us that one of the purposes of the double screen of fine gauze was to provide for flame arresting. The effectiveness of the design for this purpose was not tested, and we are not able to say to what extent, if any, it would be so effective.

⁂

At Toowoomba Farmer's Festival



This Cabin Built on to a Tractor Attracted a Lot of Attention at Last Year's Farmers' Festival held at Toowoomba. The entry was from Mr. J. Berghofer, of Wellcamp.

Tuberculosis-Free Cattle Herds

(As at 1st March, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu
Wilson & McDouall, Calliope Station, Calliope

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Queensland Fauna Sanctuaries

By C. ROFF, Fauna Officer.

The following is an index of the sanctuaries outlined in Map 27:—

Index No.	Sanctuary	Area in Acres
369	Myall Creek, Dalby	200
370	State Forest Reserve 187, parish of Daandine, via Kogan	2,554
371	State Forest Reserve 4, parishes of Braemar and Weranga, via Kogan	23,740
372	"South Wyobie," via Warra	6,000
373	"Bunya Mountains," National Park Reserves 551 and 603, State Forest Reserves 151, 395, 438 and 510, parishes of Maida Hill, Neumgna, Tureen and Haly, via Bell	36,590
	Bunya Park Estate, via Bell	2,891
374	State Forest Reserve 98, parish of Mahen, via Jandowae	1,400
375	State Forest Reserve 166, parishes of Mahen and Jandowae, via Jandowae	1,700
376	State Forest Reserves 35, 118, 197, parish of Chahpingah, Diamondy, Jingi Jingi, and Mannuem, via Chahpingah	15,370
377	State Forest Reserves 93, 266, 278 and 288, parishes of Nudley, Jingi Jingi and Canaga	26,419
378	"Durong," via Tingoora	1,125
379	Proston Sanctuary, Proston	20,418
380	"Water Reserve," Proston	11
381	"The Plains," Boondooma	10,505
382	State Forest Reserve 132, parish of Brovinia, via Cadarga	15,138
383	State Forest Reserves 15, 16, 21, 35, 46, 47, 54, 57, 61, 63, 70, 72, 80, 81, 86, 108, 132, 289, and 302, parishes of Athlone, Malcolm, MacDonald, Ballon, Coondarra, Goldsmith, Brownlie, Wongongera, Hookswood, Buchan, Bembil, Delger, Nudley, Pelham, Quandong, Warranna, Weir Weir, Cadarga, Monogorilby, via Chinchilla	744,986
384	"Eorominda," via Chinchilla	1,248
385	State Forest Reserve 137, parish of Burncluith, via Chinchilla	621
386	"Bungaban," Wandoan	118,400
387	"Bellaringa," Guluguba	11,994
388	State Forest Reserve 83, parishes of Cherwondah and Conloi, via Giligulgul	7,700
389	"Stanley Park," Guluguba	8,331
	State Forest Reserve 60, parish of Binkey, via Giligulgul	10,156
390	State Forest Reserve 66, parish of Binkey, via Gurulmundi	143
391	State Forest Reserves 64, 106, 164, parishes of Conloi, Ferrett and Bartsch, via Gurulmundi	28,313
392	State Forest Reserve 161, parishes of Condamine and Mackie, via Condamine	15,160

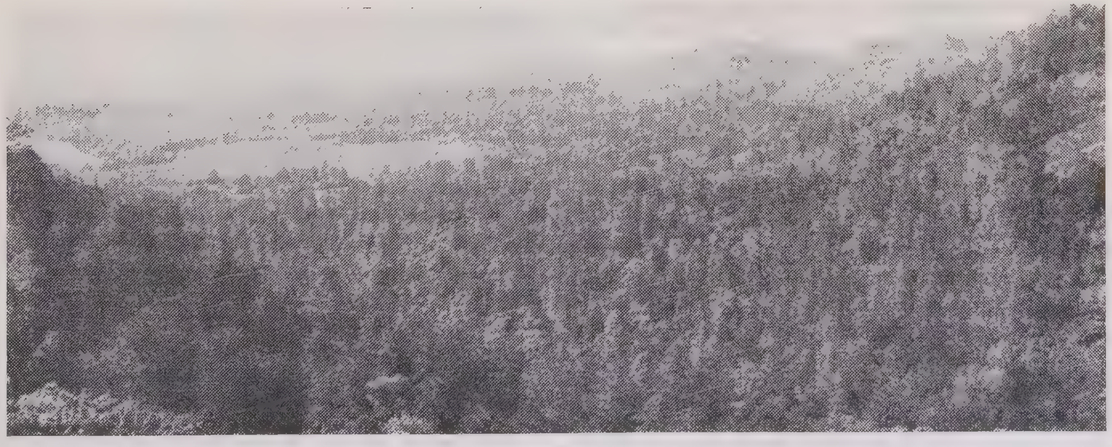
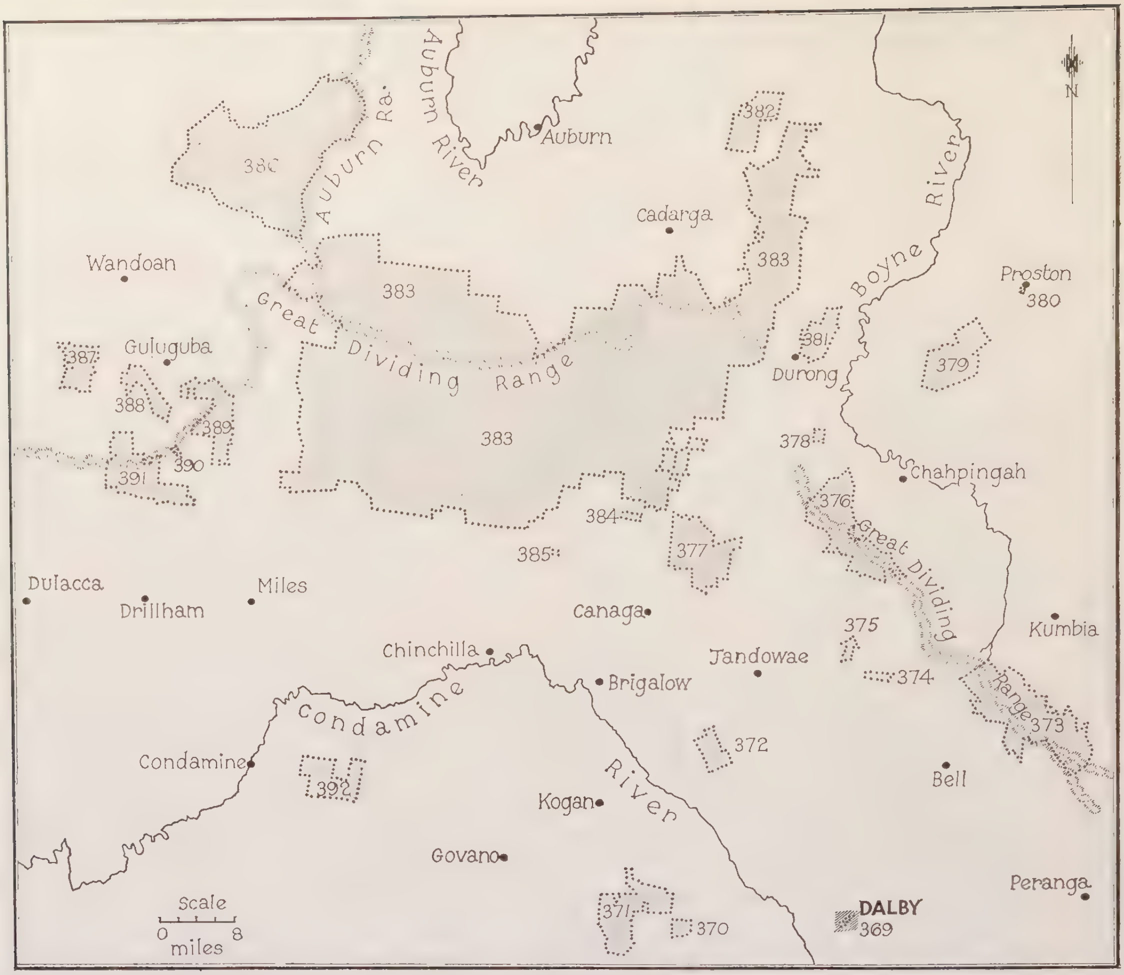


Plate 15

Fauna Habitat at Saddle Tree Creek, Bunya Mountain National Park. (Forestry Dept. Photo.)


N
Auburn Ra.
Auburn River
Auburn
380
Cadarga
382
Boyne River
Wandoan
383
Proston
380
Great Dividing Range
387
Guluguba
381
Durong
379
388
389
383
378
390
391
Chahpingah
376
384
Great Dividing Range
377
385
Dulacca
Drillham
Miles
Canaga
375
Kumbia
Chinchilla
Jandowae
374
Brigalow
Condamine
373
372
Condamine
392
River
Bell
Kogan
Govano
Peranga
Scale
0
8
miles
371
370
DALBY
369

Map 27

Map Showing Sanctuaries in Parts of Fauna Districts Nos. 1 and 4. The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines enclosing the stippled areas.

Reading For Farmers

A Melbourne bookseller has sent a catalogue which lists about 600 different titles of books on farming available in Australia.

This is a staggering total. Added to the farming newspapers, magazines and journals, these would keep a man busy in his spare time for years and years.

It's certainly a problem for the busy farmer or grazier to decide what he should read in order to keep up to date. For most people, the weeklies and monthlies are enough. Textbooks are more for the man who wants to make a real study of the theory as well as the practice of cropping, stock-raising and so on. But those of you who are interested in detailed studies of this kind, should first make sure that the recommendations in the text book apply to the conditions of your district. Findings of overseas research, for instance, can rarely be applied directly to the problems in this State. Usually the recommendations have to be modified to suit Queensland conditions.

If you have any queries on books and magazines, write to the Department of Agriculture and Stock. We should be able to help you.

Saving Lambs By Hand Feeding

By J. GIBB, Sheep Husbandry Officer, Cunnamulla.

In the south and south-western sheep-breeding areas of Queensland, fairly reliable rain can be expected in February and March and also in June and July. This forms a pattern of summer grass followed by winter herbage and is perhaps the main reason why over 95 per cent. of the ewes in the area are mated in autumn to lamb in spring.

In years of abundant summer rain, even if winter rains and spring storms fail, there is usually enough dry feed for the majority of ewes to bring their lambs through to marking. However, in that section of sheep country west and south of Cunnamulla, no general rain of any consequence fell after July during 1956. The summer rains of 1957 followed a dry spring during which dry feed was plentiful. The rains were neither general nor heavy but did give sufficient "pick" on which pregnant ewes might "winter." However, when the expected winter rains, and also the spring storms of 1957, failed, it was apparent to the majority of graziers that many lambs would die. The reason for this was the poor condition of the dams and the unavailability of soft nutritious feed that the lambs could handle when the ewes became dry.

Those concerned with the management of three properties within a 50 mile radius of Cunnamulla decided that one possible solution was to take the lambs off the dams at approximately 6 weeks of age and hand-feed them in yards. The ewes would quickly become, in effect, "dry" sheep; the stocking rate of the property would be reduced and results from experimental work in 1951 and 1952 suggested that the lambs could be kept alive and healthy reasonably easily and economically by intensive hand-feeding.

Experiments

Two of these three independent decisions on the part of sheep breeders in such a restricted area were a direct outcome of a graziers' organised Field Day at "Charlotte Plains," Cunnamulla, on November 13, 1957. It was attended by Dr. M. C. Franklin, a senior Research Officer of the Commonwealth Scientific and Industrial Research Organisation, who has been actively concerned with drought feeding of livestock in Australia for many years.

In brief, Dr. Franklin reported that his research group had, in 1951, weaned lambs at 4, 8, and 12 weeks of age, and attempted to rear them on bought fodders. Lambs weaned at 8 and 12 weeks did well, but only 24 per cent. of the lambs weaned at 4 weeks survived. The trial led those in control to believe that if lambs were to be weaned early under conditions that would probably prevail in pastoral Australia, they must be at least 6 weeks of age and 16 to 18 lb. liveweight.

In 1952, a group of 32 lambs, 6 weeks of age and having an average liveweight of 16·8 lb. were drafted off their dams and allowed free access to a diet of 50–50 lucerne chaff and whole oats. Twenty-seven lambs survived and had an average liveweight of 53·3 lb. at 23 weeks of age, and 82 lb. at 7 months.

The average daily feed consumed during the 75 days after weaning is shown in Table 1.

TABLE 1

Days After Weaning	Average Daily Feed Eaten
0–14 days	0·4 lb. per head
15–44 days	0·63 lb. per head
45–75 days	1·13 lb. per head

Field Undertakings

Property A: At approximately 6 weeks of age, 290 lambs were weaned into the shed yards. No body weights were taken, but the lambs were quite unthrifty. They were fed twice daily on 0·7 lb. lucerne per head, per day, and given access to one bag of whole oats in one feed, once each week. Feeding commenced in late October, 1957. By February 24, 1958, 60 lambs had died over a number of weeks in small numbers. Chronic scours, progressing to a weakness in the hindquarters 48 hours prior to death, was a common condition amongst those that died. The 230 survivors, although strong, were very small in stature. In fact, at the time of writing these notes, they appeared so stunted that experienced sheepmen were doubtful if they would ever recover sufficiently to grow into economical sheep.

Property B: 1,885 lambs having an average age of 6 weeks were drafted into a 40-acre paddock on December 22, 1957. No body weights were taken, but small lambs obviously under 16 lb. liveweight were placed in a small netted area and fed separately for some weeks. All lambs were fed 1 lb. lucerne hay once daily.

During January, 1958, the price of lucerne rose sharply to £50 per ton and another source of fodder was sought while some hay was still on hand. Nine tons of whole wheat at £35 per ton were obtained. This was gradually incorporated into the ration from mid-January. By that time, daily feeding had been surpassed by twice-weekly feeding.

During the first week in February, the ration consisted of 40 per cent. wheat and 60 per cent. lucerne hay. The lambs were receiving approximately 6 oz. wheat plus 10 oz. lucerne hay per head per day. The two types of feed were fed in separate trails from the back of a utility. The fact that the fodders were not mixed may have been a contributing factor to the losses which subsequently occurred. After the lambs had been 3 weeks on the mixed diet, and during the time wheat comprised no more than 40 per cent. of the ration, losses occurred overnight. They continued for 3 days. Although well over 100 lambs were affected, only 31 were lost. The abnormality disappeared once wheat was removed from the ration.

Affected lambs were depressed and reluctant to move. When forced to do so they appeared to be sore in all four feet. The more severely affected scoured, were continually straining, and could only walk in a half-crouch. This gave the impression that they were "gone in the coupling." Eventually they became prostrate, at which stage the body temperature measured a constant 107 deg. F. Lambs which showed the more severe symptoms died. The general symptoms observed were indicative of acidosis, or grain poisoning.

On February 22, the surviving 1,852 lambs were in good, strong, store condition, and were being fed twice weekly at the rate of 1 lb. lucerne and 1 oz. of wheat per head per day. The two constituents were mixed together. Up to that date, feeding had been in progress 9 weeks for an outlay of 11s. 9d. per survivor. An additional purchase of 20 tons of lucerne hay was estimated to provide for further feeding of the sheep for a total of 12 weeks at a cost of 15s. 2d. per head.

Property C: The work done on this property was under the direction of the C.S.I.R.O., and will, no doubt, be published elsewhere. For the purposes of this comparison it is sufficient to know that a group of lambs in excess of 1,000 was fed lucerne hay twice weekly, at a rate of 1·7 lb. per head per day, for the 8 weeks prior to February 22, 1958. The lambs were born into a long-range breeding experiment and it was wished to give them the best possible chance for survival.

These lambs finished in prime condition, and fully bear out Dr. Franklin's suggestion, in the light of his experiments, that lambs can be weaned early and reared on lucerne hay. The cost of maintaining the lambs in this condition was 12s. 4d. per head per month, or 37s. for a 3-month period.

Unfortunately, the expected summer rains of February and March failed on all three properties for the second year in succession and some revision of the programme became necessary.

These Facts Will Help

However, the undertakings brought forward the following facts which are of importance to graziers who at some future time may have to contemplate feeding lambs, or letting them take their chance:

(1) Lambs can be successfully weaned at approximately 6 weeks of age under routine station surveillance.

(2) Dams become dry sheep and pick up condition very quickly, even on dry roughage alone.

(3) Lambs that were fed 0·7 lb. lucerne hay per head per day with a small supplement of whole oats, although strong, lacked growth and showed no likelihood of becoming worthwhile sheep.

(4) Lambs fed 1 lb. lucerne hay per head per day for at least 9 weeks maintained good forward store condition in spite of a temporary setback because of digestive upsets due to feeding wheat.

(5) Lambs fed almost 2 lb. lucerne hay per head per day for 8 weeks became prime, which, in the light of (4), could suggest a waste of feed under conditions where fodder is being bought on the open market during a time of drought, for feeding to commercial sheep. However, where lambs are to be fed for stud purposes or experimental reasons, this level of nutrition would be desirable.

(6) The feeding of lambs for survival on bought fodders under yard conditions is not unaccompanied by digestive upsets in a small percentage of sheep.

Bi-weekly feeding of lucerne hay produced some losses from bloat on property C during the first month of operations. Bloat appeared in the lambs on property B, as soon as bi-weekly feeding was commenced, but no known losses due to this condition occurred.

The feeding of grains produced digestive upsets, accompanied by deaths on both properties, A and B. In the light of present knowledge it would be wise to restrict the feeding of grains to lambs so that they never exceed much over 50 per cent. of the ration. They should be intimately mixed with the other constituents. Wheat may be more troublesome than oats and should be fed at some level below 50 per cent.

When commencing to hand-feed lambs, the entire diet should be roughage for at least 10 days. The grain portion can then be increased in steps of 5 per cent. each 10 days until the desired level is reached. When undertaking the prolonged feeding of high grain rations to young sheep, finely ground limestone should be added so that it comprises 1 per cent. of the ration.

(7) In these trials it will be noted that the weaners were fed in very small areas. This was in keeping with the findings of earlier research work, which showed that this was very important.

(8) Economically the feeding of lambs for short stretches before periods of most reliable rain seems sound. It would become more so if lucerne hay were stored on properties during times of plenty at as low a total cost as possible. One hundred tons of good lucerne hay stored for an average price of £15 a ton could keep 2,000 lambs alive for approximately 3½ months, if fed at the rate of 1 lb. per head per day. This would place a cost of 15s. on the lambs at the end of feeding. If a drought market for fodder has to be met the cost could be easily two or three times as much as this.

Purchase of grain for storage at times of low cost could also contribute to more economically sound feeding when drought eventuated. Purchase of hay and grain could be estimated to permit suitable proportions to be fed following conditioning of the weaners to take grain.

◆

Wool Is Still The Superior Fibre

"Despite the magnitude of research achievements of the manufacturers of synthetics, they have *so far* been unable to produce a fibre comparable with wool in its present form. Nevertheless, consistent improvements in synthetics are gradually closing the gap."

—*Extract from a market research report.*

Brucellosis-Tested Swine Herds (As at 1st March, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Clark, L. D., Greens Creek, Gympie
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton" Stud, Maleny
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson. K. L., "Warra". Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Mannuem Brae" Stud, Mannuem, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Skyring, G. I., "Bellwood" Stud, via Goomeri
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Campbell, P. V., "Lawnhill" Stud, Lamington
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Helidon

Wessex Saddleback

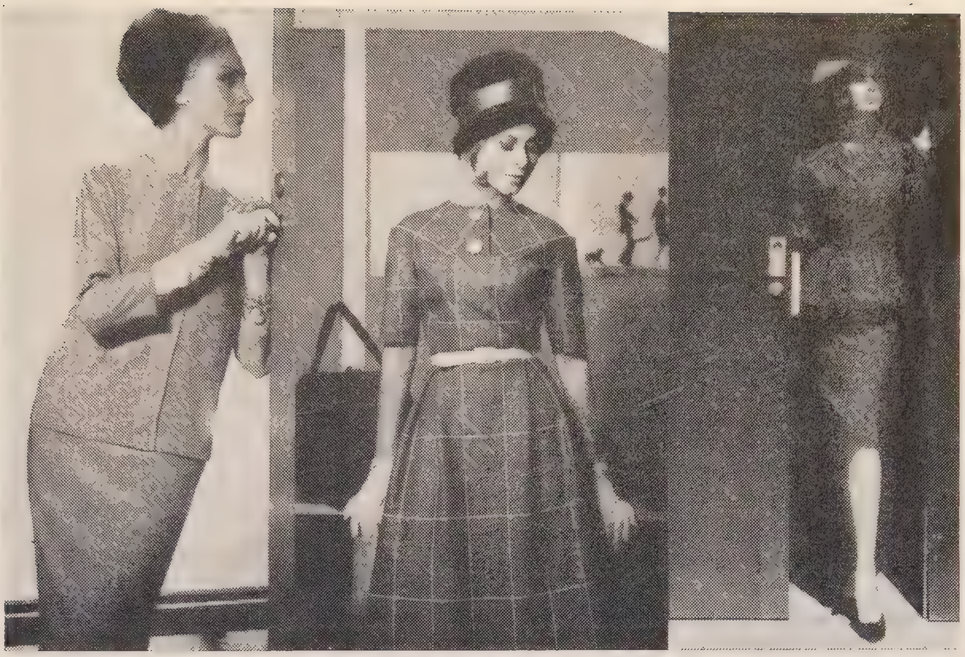
Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B.. "Kunawyn". Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn," M.S. 74, Clifton
Kingsford, D., "San Antone", Toowoomba
Kruger & Sons. "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., "Topcamp", via Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Toowoomba
Law, D. J., Rossville Stud. Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Pointon, E., Goomburra, M.S. 869, Allora
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F.. French's Creek. Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton

Large Black

Pointon, E., Goomburra, M.S. 869, Allora



Left: The metalled thread in this outfit is used to highlight the colour—soft mauve—of the fine wool from which the garment is knitted. Centre: A pure wool knitted fabric dress is suitable for morning and afternoon wear. The dress is in peat beige with a large overcheck in lemon and pepper green. Right: Superbly elegant dress and jacket in an open weave wool fabric.

Woolknits For Autumn And Winter

Woolknit suits for women and pullovers and vests for men will be the fashion story for autumn and winter, 1961. This is evident from the Australian Wool Bureau's Wool Fashion Awards contest, finalised in Sydney.

Pale "bright" colours will be a big feature. Colours vary from stone to possum grey; cardboard yellow to hazy lemon; wood brown to coffee bean brown.

The Chanel line for woolknit suits is still a strong fashion favourite with the added attraction of a pert "top" to match or contrast.

An old favourite with a new look is the seven-eighths length knitted coat—but with a difference. The coat is stick-slim to match the skirt. Many bulky-knit ensembles are well to the fashion fore.

The Autumn/Winter look for men is the "vested look" in cardigans. Another purely male look is the chunky-knit sweater with the skiing influence very strong. Designs are predominantly Austrian styled with the fairisle pattern.

Woolknits have crept into the day dress section too.

The successful return of purple is evident, varying in all shades from hazy-mauve to a brilliant deep tone.

In the casual dress section, woolknits once again are popular. Knitted wool relaxing outfits of tapered and trim slacks with a sophisticated cardigan to match are a feature.

Pictures of some of the gold medal winners accompany this story to illustrate winning trends in wool.

stock and station

Cottonseed Meal Poisoning in Calves.—On a south Queensland dairy seven calves out of a group of 15 died from suspected cottonseed meal poisoning. Cottonseed meal has been more plentiful than other protein-rich meals and to avoid risk of poisoning it should be fed at not greater than 20 per cent. of the *meal* ration.

Toxicity is due to traces of a natural poison in cottonseed called "gossypol."

Poisoning is related to age. Younger calves are highly susceptible and poisoning on a moderate diet of cottonseed meal may occur. Pigs and poultry too are very susceptible.

Sudden deaths after prolonged feeding on the meal are usual. Clinical symptoms are not often observed and calves may die in a few minutes following two to three months of uneventful feeding on the meal.

Symptoms, if seen, include a "redwater," hindquarter stiffness, laboured breathing and a near-normal temperature. Adult cattle are not affected.

If these symptoms are encountered in a calf group, cottonseed meal should be withheld for a time.

—*E. R. JOHNSON, Veterinary Officer.*

Mysterious Deaths of Pigs.—During the summer months we hear occasionally of pigs found dead for no apparent reason, and the common verdict has been "snakebite". A thorough investigation, however, usually shows that feeding milk under dirty conditions was responsible.

To avoid these summer-time losses, or digestive upsets, separated milk must be kept clean, and fed in clean troughs. It is best to feed it regualrly either sweet or soured, but in either case it must be kept clean.

Drums in which milk is stored must be clean. Each time they are emptied they should be swilled out, and once or twice a week scrubbed out. Drums caked on the inside with dirty milk curds sour the next lot of milk quickly, and in hot weather dangerous bacteria multiply rapidly.

Troughs are another common source of trouble. Cracked, rough and pitted troughs, with sharp inside corners retain milk in which bacteria multiply between feeds. Milk spilled onto muddy ground around the troughs is another source of danger.

Where milk is being fed, and especially in summer, keep the storage drums clean, and scrub them at regular intervals. Don't put fresh milk in with any left over from the previous feed. Keep the drums in a cool, shady place. Don't use cracked or pitted troughs. Never fill the troughs so full that milk is splashed out by the pigs, or left in the trough after feeding. Set the troughs on a properly drained concrete floor.

By keeping to these commonsense suggestions, unnecessary and unexpected losses of valuable pigs can be avoided.

—*T. ABELL, Senior Adviser, Pig Branch.*

Treating Phosphate Deficiency In Beef Cattle

By L. E. DONALDSON, Husbandry Officer, and
W. F. MAWSON, Senior Adviser in Cattle Husbandry.

Throughout large areas of Queensland, beef cattle are grazed on pastures that are seasonally deficient in the mineral phosphorus. The direct result is that reproductive efficiency is reduced, cattle grow slowly and imperfectly and are unable to withstand drought conditions.

The following are some of the areas in which phosphate deficiency of cattle is prevalent; they are by no means the only areas of Queensland in which the condition occurs:

1. The coastal belt from the New South Wales border to, and including, Cape York Peninsula, and in particular the "wallum" country. The only exceptions are a few fertile river valleys.
2. The coastal tableland west and south-west of the Atherton Tableland.
3. The Charters Towers area, comprising about 5,000 sq. m. in the watershed of the Cape and Campaspe Rivers and on the Dividing Range at Pentland. This is a severe "peg leg" area.
4. The Cloncurry-Barkly Tableland area extending into the Northern Territory. An area comprising about 9,000 sq. m. on the north-east watershed of the Saxby and Norman Rivers is another particularly severe "peg leg" region.
5. The fringe of the Darling Downs in the Chinchilla and Miles areas.

PHOSPHATE IN THE BODY

Phosphate is an essential element in animal nutrition. It plays an important and major part in the formation of bone and teeth and is present in many vital organs, such as nerves, liver, muscle and blood. It is essential for many of the digestive processes of the animal, involving the conversion of feed into energy and the building up and repair of body tissues. The signs of phosphate deficiency are the result of the reduced efficiency of these bodily processes.

The animal's phosphate requirements have to be provided by the food it eats. A deficiency of phosphate in the ration results in a deficiency in the animal.

Symptoms of phosphate deficiency generally are seasonal in occurrence. The phosphate content of pasture is at its peak when the pasture is growing, and falls off rapidly as the pasture matures. The result is that many cattle are not obtaining sufficient phosphate from April until new growth of pasture is well established in the following spring or summer.

In grossly phosphate deficient areas such as the "peg leg" areas of the Cape, Campaspe, Saxby and Norman Rivers, it is very doubtful whether the phosphate intake of cattle reaches optimum, or most favourable, levels for an appreciable length of time at any stage of the year.

SYMPTOMS

Symptoms of phosphate deficiency vary from a mild condition, in which there are no obvious signs, to the grossly deficient "peg leg" animal.

The earliest symptoms are rough coat, and decrease in appetite, growth rate, milk production and efficiency of feed use. These effects are followed by signs of depraved appetite and bone chewing. Prolongation of the condition leads to specific bone changes. These bone changes cause knee joints to enlarge, giving an appearance of knock-knees. Bony protuberances may develop at the joints. There is arching of the back and the animal is disinclined to move but when so doing it shows a short, stiff, proppy gait. This is the condition known as "peg leg".

Some animals become severely depleted in phosphate without showing signs of "peg leg". These animals have soft bones which are prone to fracture, even during normal handling. In a recent case an animal broke its back in the crush while a blood sample was being collected and a post-mortem examination revealed extensive old, unrepaired fractures of the ribs, obviously caused by knocks against posts. The ribs were so soft that they could be easily broken by hand pressure. Broken legs may occur if animals race down-hill.

The condition is most prevalent in younger cattle between 1 and 3 years. Young lactating and/or pregnant females are particularly susceptible. This is because the phosphate requirements of growing animals are greater than those of the mature animal. The young breeding cow needs phosphate for growth and for pregnancy and milk production. This is one reason why heifers in phosphate-deficient areas should not be mated until they are 2 years old.

TREATMENT

In considering the treatment of phosphate deficiency it should be realised that other nutritional deficiencies are likely to be present at the same time. For example, a protein deficiency usually occurs concurrently with phosphate deficiency in cattle when they are grazing unimproved pastures during the winter period. However, while it may not be practicable to treat all the deficiencies at any one time, some advantage will be obtained by alleviating those which can be dealt with on a commercial basis. For that reason the treatment of phosphate deficiency merits consideration by all stockowners whose holdings are located in phosphate-deficient areas.

There are two important considerations of a general nature which are fundamental to successful and economical phosphate supplementation.

Firstly, the animals most affected by phosphate deficiency are young, growing animals and breeding animals, especially the young cow. Prior to supplementation, animals should be classed and paddocked in comparable groups. This ensures that stock whose needs are greatest are treated and avoids wastage of phosphate on animals which give a lower return from it. For example, providing a phosphate supplement to a mixed group of weaners, breeders and bullocks is not the most efficient way of using a limited amount of supplement. Unless the intention is to supplement all animals, the bullocks should be excluded since as a group they are able to live on a diet lower in phosphate.

Secondly, a regular supply of the supplement is much more effective than an intermittent supply, even though consumption under the two methods may be the same. It is also a sound policy to supply the supplement before severe symptoms appear in animals. It is preferable to maintain a satisfactory phosphate status rather than to attempt to overcome a low level in the animal.

THE SOIL

It has been stated that animals become phosphate deficient because of a low phosphate level in the diet—which in most cases is grass. Grasses obtain their phosphate content from the soil in which they grow. An increase in available phosphate in the soil will result in plant growth which has an increased phosphate content. Since phosphate is a mineral necessary for plant growth, the correction of a deficiency of that element in the soil will result also in a greater growth of plant material. The treatment of a phosphate deficiency in animals by treatment of the deficiency in the soil is a good method where it is applicable.

Unfortunately, its application to the treatment of phosphate deficiency in beef cattle in Queensland is very limited.

These limitations stem from the comparatively low carrying capacity of native pastures, which would entail the top-dressing of prohibitively large areas in order to treat a few head. In addition, on some soil types responses to phosphatic fertilizers are limited because chemical actions make portion of the phosphate unavailable to plants. Except in specific cases, and on a comparatively small scale, top-dressing of pastures is unlikely to play a significant part in the treatment of phosphate deficiency in beef cattle at the present time.

Plate 1

Phosphate Deficiency Aggravates the Effects of Drought. This cow is suffering from both.

THE ANIMAL

In most cases, direct treatment of the animal by phosphate supplementation in some form is the most practicable. This involves some general aspects which will be considered before proceeding to a discussion of methods.

Some definition of terms is desirable. Phosphorus, which has the chemical formula of P, is the active constituent. The worth of a supplement depends on its content of phosphorus. However, phosphorus combines with oxygen to give phosphoric acid. Phosphoric acid is expressed by analysts in terms of its P_2O_5 content; P_2O_5 is popularly referred to as phosphate. All commercial phosphate supplements are required by law to carry a label on each bag. This label shows the phosphate content of the material and also the source of the phosphate. It is expressed as " . . . per cent. minimum phosphoric acid (P_2O_5) from . . ."

Phosphorus (P) comprises approximately three-sevenths of P_2O_5. Accordingly, on a weight basis 2⅓ lb. of P_2O_5 contain 1 lb. of P. An example will make this clear. Bonemeal contains 25 per cent. P_2O_5, according to the label. The P content of bonemeal is three-sevenths of the P_2O_5 and thus bonemeal has a P content of three-sevenths of 25 per cent. which is nearly 11 per cent.

Animal requirements are often expressed in terms of grams of P. A gram is taken as one-thirtieth of an oz. for purposes of calculation.

RELATION BETWEEN CALCIUM AND PHOSPHORUS

There is a relationship in the use of calcium and phosphorus by the animal body. However, it is doubtful whether an imbalance between these minerals leads to serious phosphate deficiency in cattle grazing native pastures in Queensland. There is no evidence to show that grazing animals in Queensland suffer specifically from a calcium (lime) deficiency.

Thus for Queensland conditions, the important aspect to consider in a mineral supplement is the content of P_2O_5 and not CaO or lime, because deficiency of P_2O_5 is the condition requiring correction.

ANIMAL REQUIREMENTS

The phosphorus requirements of cattle are shown in following Table 1.

TABLE 1

Class of Animal	Phosphorus Requirements in Grams Daily
Weaners and Yearlings (normal growth)	10–13
In-calf heifers and cows	12–15
Cows nursing calves first 3–4 months after calving	20–23

NOTE: 1 gram is approximately one-thirtieth of an oz.

It should be noted that weaners require nearly as much phosphorus as older male cattle and since weaners have a smaller capacity for food the concentration of phosphorus in the foodstuff needs to be higher for young stock. Note also the high requirement of the cow which is nursing a young calf.

When animals are grazing they are obtaining some phosphorus, even though the pastures have a low phosphorus content. However, it is practically impossible to know just how much of its requirements an animal is obtaining. The matter of how much supplement to feed is then a matter of trial and error. When a known quantity is supplied some arbitrary level has to be set and then varied, if necessary, in the light of the response to the animal. This difficulty does not arise when an animal is allowed free access to a phosphate supplement. However, it has an influence in knowing the required concentration in drinking water.

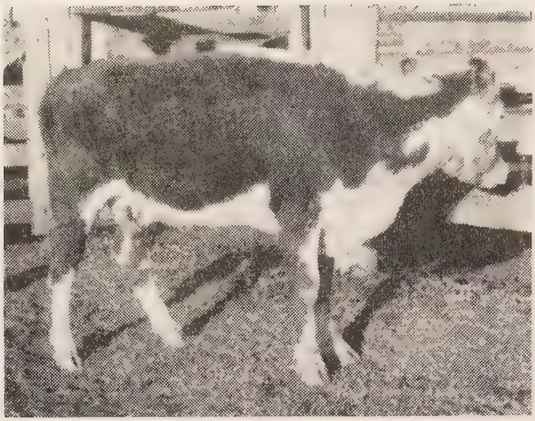


Plate 2

A Phosphate Deficient Animal under Better Conditions. Note the arched back, narrow girth and elongated bones.

The results of a 5-year experiment in U.S.A., using three different forms of supplementation to breeding cows with their calves depastured on phosphate deficient pastures, indicated that a supplement of 6·5 grams for each cow daily and 14·3 grams when cows were nursing young calves gave satisfactory results. These breeders were considerably larger than the average in Queensland and the calves were considerably heavier at weaning. Taking a line through this work, estimates of requirements for cattle grazing moderately phosphate deficient pasture in Queensland are made, as set out in Table 2.

TABLE 2

Class of Animal	Supplement Requirements per day	
	Grams Phosphorus Daily	Oz. of Bone Flour 25% P_2O_5
Young, growing stock	4–5	1⅓
In-calf heifers and cows	5–6	1½
Cows nursing young calves . .	11–12	3½

TYPES OF SUPPLEMENTS

Phosphate supplements fall into two broad groups. One concerns the use of the supplement in a feedstuff or in a lick mixture. The second involves the use of a supplement in drinking water. Examples of these are sterilized bone flour for use with a feedstuff and superphosphate and mono-sodium orthophosphate for water supplementation.

The value of a supplement should be determined in terms of the cost of the phosphorus which it supplies. This can be compared on the basis of its stated percentage of P_2O_5, or the percentage of P_2O_5 can be converted to grams phosphorus per lb. of supplement. For calculation purposes a doubling of the P_2O_5 per cent. content gives grams of phosphorus per lb. of supplement. The steps in calculation for obtaining a comparison are shown in Table 3. Prices given are only approximate.

TABLE 3

Supplement	P_2O_5	Grams P. per lb.	Cost per ton	Cost per lb.	Cost per gram P.	Cost 5 grams P.
	Per Cent.			*d.*	*d.*	*d.*
Bone flour	25	50	£31 short ton . .	3·72	0·074	0·37
Super-phosphate	19% water soluble	38	£14 long ton . .	1·5	0·039	0·20
Mono-sodium orthophosphate	58	116	£180 long ton . .	19·28	0·166	0·83

METHODS OF SUPPLYING SUPPLEMENTS

The practical commercial methods of providing a phosphate supplement are inclusion in a feedstuff, as a lick in troughs, or in solution in drinking water. These are now discussed in more detail.

1. Inclusion in a Feedstuff

This is possible where crushed grain or a meal is fed as a supplement during winter months. Protein-rich meals are in themselves comparatively rich in phosphate. Meat-and-bone meal contains approximately 17 grams of phosphorus per lb. and cottonseed meal has about 5 grams of phosphorus per lb. Other protein-rich meals contain about 3 grams of phosphorus in each lb. while grain sorghum contains 1·4 grams of phosphorus in each lb. of grain. In order to supply 5 grams of phosphorus in 1 lb. of grain sorghum it would be necessary to add 8 per cent. of bone flour. Thus, the mixture would be 100 lb. grain and 8 lb. of bone flour.

The phosphorus content of principal foodstuffs is given in the *Queensland Agricultural Journal,* January, 1960, pages 9 and 10. Consideration of these values, taken in conjunction with the rate of feeding, will show how much phosphate supplement will be required.

Provided that the method of feeding is such that all animals are able to obtain a fair share, this method of supplementation is satisfactory. Phosphate supplements derived from bone are suitable for this method.

2. Provision of Licks

Supplements derived from bone are suited to this method. The phosphate supplement is usually combined with coarse salt, which has the effect of making the supplement more palatable to stock and reduces losses due to wind. When commencing this method it may be desirable to use a 75:25 salt to bonemeal mixture by weight.

The proportions can then be changed gradually until the mixture consists of 75 parts of bonemeal to 25 parts of salt. In practice a 50 : 50 mixture of salt and bonemeal is popular.

Such a mixture is offered to animals on a free access basis and should always be available during the term of the feeding period. The quantities eaten by phosphate-deficient animals may be high initially but consumption normally levels out after a few weeks.

It is most desirable that licks of this nature should be protected from wind and moisture. This is done by the use of covered troughs. Should the lick mixture become moist and "caked" it should be discarded and replaced with a fresh batch. Regular attention is required to keep the troughs stocked up and for this reason it is convenient if a motor vehicle can be taken to the site. During damp weather such a lick mixture will absorb moisture from the atmosphere and for this reason it is not a suitable supplement during the "wet season" months.

Two ounces of a 75 : 25 bonemeal to salt mixture provides 5 grams of phosphorus, and this is a reasonable estimate of average consumption for a group of cattle.

This method is criticised because some animals tend to take more of the lick mixture than is necessary while others refuse it altogether. While this does occur, the results from field trials suggest that the method is as efficient as water supplementation and is well worthwhile.

The lick mixture just discussed is in loose form and many graziers prefer a block form for ease of handling and storage. For many years, block licks with a high phosphate content were not available. However, the position is changing and feed supplements in block form containing appreciable amounts of phosphate are becoming available commercially. The block supplements which contain worthwhile quantities of both phosphate and digestible protein will supply the most pressing needs of beef cattle grazing native pastures during winter.

3. Soluble Phosphate in Drinking Water

Equipment has been developed recently which delivers a quantity of treated water into the trough supply. A small tank to hold the concentrated solution is located near the inlet to the trough and delivery from it is fixed in proportion to the water intake at the float valve.

This system is effective only where there is no alternative water supply for the animal. In practice it is restricted to a water supply from a tank and delivered by the force of gravity to a trough through a float valve. It may be inadequate for large mobs of cattle drinking at one time.

In making up the concentrate solution, it is necessary to use water-soluble phosphate. Two forms are available—superphosphate, which is used at a phosphatic fertilizer, and mono-sodium orthophosphate.

Superphosphate requires special treatment before it can be used. It is derived from rock phosphate and has a relatively high fluorine content. Fluorine is a violent poison when taken in considerable amount and also has a cumulative effect at smaller intakes. Excess fluorine causes faulty enamel of the teeth and softening of the teeth and bones. For this reason, plus its lack of palatability and the likelihood of causing digestive upsets, superphosphate as such should not be used. However, it can be used after treatment in the following manner:

The superphosphate has to be very thoroughly mixed with water in order to bring the phosphate into solution and allow the fluorine and other material to settle out. Mixing is done at the rate of 5 lb. of superphosphate to 1 gal. of water. Mixing must be very thorough to be effective and for this reason it is best to attempt small quantities at one time. A suitably sized mix is 50 lb. of superphosphate in 10 gal. of water in a half-44 gal. drum. A wooden paddle makes for good mixing and care should be taken to get all the superphosphate in a thoroughly saturated state. Pouring the mixture from one vessel to another during the mixing assists the mixing procedure.

At the completion of the mixing the material should be allowed to stand overnight. After this settling-out period the fluid should be taken off and the sludge discarded. The fluid contains the phosphate which has been brought into solution and this is the concentrate solution used in making up the water supplement. The concentrate solution is stored in the small tank situated at the inlet end of the trough.

If mixing has been complete, a concentration of 50 lb. superphosphate in 10 gal. of water will provide 190 grams of phosphorus per gallon. When the dispenser of this concentrate is regulated to deliver 20 c.c. of concentrate for each gal. of trough water, the latter will then contain approximately five-sixths of a gram of phosphorus per gal. Six gal. of drinking water would then supply 5 grams of phosphorus. In practice in the field it is rather optimistic to assume that more than 75 per cent. of the soluble phosphorus will be brought into solution. If a solubility rate of 75 per cent. is obtained a delivery of 20 c.c. of concentrate per gal. gives a phosphorus content of five-eighths of a gram per gal. of drinking water. Eight gal. are then required to supply 5 grams of phosphorus.

The following should be observed: Some "hard" waters cannot be successfully supplemented by this method. "Soft" water is satisfactory but if there are doubts a sample should be forwarded to the Biochemist, Animal Research Institute, Yeerongpilly, for analysis and advice. This form of supplementation is unsatisfactory in muddy water. For example, the emptying of a quantity of superphosphate into a bulk supply of water would be a useless attempt at supplementation. The concentrate solution has a tendency to form deposits on metal and also act as a corrosive agent. Constant attention is necessary to ensure the efficient working of this form of supplementation and weekly checking and maintenance are desirable. The original mixing proportions of 5 lb. of superphosphate to 10 lb. of water should not be varied.

In practice the comparative cheapness of superphosphate as a supplement is somewhat offset by the difficulties and labour cost of mixing. The effect of the superphosphate concentration on the efficient operation of the dispenser is not known but corrosion may prove a big obstacle with this material. Further, the concentration which can be achieved is rather low for the treatment of a severe deficiency.

On a small scale the concentrate fluid from a mixture of 5 lb. of superphosphate to 1 gal. of water emptied into 190 gal. of drinking water gives a concentration of 1 gram of phosphorus per gal. Where convenient, this method can be used on a larger scale. It avoids the use of a dispenser but requires control over the bulk water supply.

Two cement-lined tanks are needed for best results with this method. The smaller tank of say 800 to 1,000 gal. is used purely as the immediate supply of treated drinking water and it serves the drinking trough. It draws on the larger tank for supplies. The larger tank receives water direct from the pump or mill and should be calibrated in 500 or 1,000 gal. capacities.

The fluid obtained after mixing 50 lb. superphosphate in 10 gal. of water will "charge" 1,900 gal. of tank water at a concentration of 1 gram per gal. if full solubility is obtained. At a solubility of 75 per cent., 50 lb. of superphosphate in 10 gal. of water would provide sufficient concentrated solution for 1,400 to 1,500 gal. of drinking water.

In charging, the supply from the large tank should be shut off. As water is pumped into the large tank the appropriate quantity of concentrated solution should be added until the large tank is as full as practicable. This supply then serves the smaller tank until a further charging of the main tank is needed. Water should not be added to the main tank continuously but is restricted to periods when charging is taking place.

In practice it is possible to stop the flow from the main tank one afternoon, take note of the water level at that time, and commence pumping into the main tank. The following day the quantity of fresh water pumped in is read off and the appropriate quantity of concentrate solution added. With a little experience and observation of pumping capacities a routine of operations can be developed.

A green scum of algae and other plants may form on water containing phosphate from superphosphate. This can be prevented by the use of copper sulphate (bluestone). Dissolve 1 oz. of bluestone in a small quantity of hot water and make up to 2 gal. of water. Each half pint of this solution is sufficient for the treatment of 800 gal. of drinking water.

Mono-sodium orthophosphate is also suitable for use as a water supplement. It is used by means of a dispenser delivering a proportionate amount of concentrate fluid. This form of phosphate mixes fairly readily with water and is simpler to use than superphosphate since it can be mixed and placed directly into the concentrate storage tank. Reference to the comparative table shows that this form of phosphate is more costly than superphosphate on the basis of the cost per lb. of phosphorus but it is much more convenient for water supplementation. A concentrate solution made by mixing 20 lb. mono-sodium orthophosphate in 10 gal. of water will provide 230 grams of phosphorus per gal. of concentrate solution. When 20 c.c. of this is delivered into 1 gal. of drinking water, the water would then contain 1 gram of phosphorus per gal.

For easy comparison, Table 4 has been prepared:

TABLE 4

Material	Mixing Rate	Phosphorus Content in Concentrate Solution
Superphosphate ..	5 lb. per gal. of water	190 grams P. per gal.
Mono-sodium orthophosphate	2 lb. per gal. of water	230 grams P. per gal.

The quantity of phosphorus supplied in 1 gal. of drinking water by adding the concentrate at various rates is shown in Table 5.

TABLE 5

Concentrate Solution	Output of Dispenser per Gal. Drinking Water		
	15 c.c.	20 c.c.	25 c.c.
Superphosphate ..	0·63 gm. P.	0·84 gm. P.	1·05 gm. P.
Mono-sodium orthophosphate	0·75 gm. P.	1·00 gm. P.	1·25 gm. P.

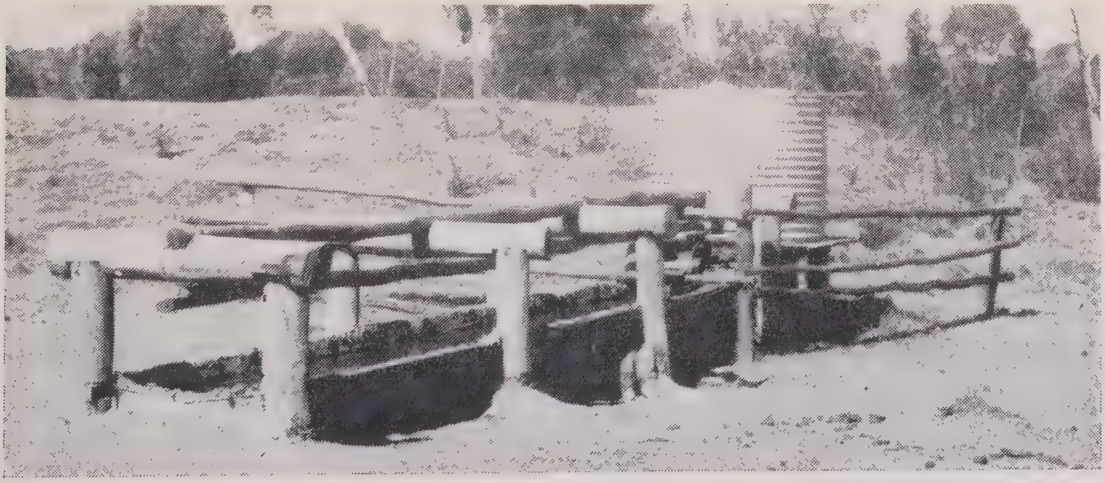


Plate 3

Water Supplementation Using a Concentrated Solution of Phosphate in Water in the Small Tank at the End of the Trough. The bulk water supply is gravitated from the "turkey-nest" dam in the background.

For practical purposes, it is considered that a concentration of 1·2 grams phosphorus per gal. is the limit which can be achieved without seriously affecting the palatability of the water.

Having overcome the difficulties involved in maintaining a suitable level of phosphorus in the drinking water, the effectiveness of this form of supplement depends on the quantity of water which the animals drink. Observations on adult cattle on range in Africa during the dry season disclosed that daily water consumption amounted to approximately 7 per cent. of bodyweight. Thus an 800 lb. breeder would drink 5½ gal. daily plus an amount equal to the quantity of milk she was producing. A 400 lb. weaner would be expected to drink between 2½ and 3 gal.

Either water supplementation or the provision of licks will deal satisfactorily with a moderate phosphate deficiency. In very severe cases it may be desirable to combine these methods or better still, supply a little high-protein meal which is suitably fortified with a phosphorus supplement.

The construction of a cheap and effective lick feeder is shown on page 731 of the *Queensland Agricultural Journal,* Nov., 1959. Reprints of this article are available from the Department of Agriculture and Stock.

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Plate 1: **Section of the Grazing Trial.**

Yields from Irrigated Pastures in the Burdekin

By G. H. ALLEN, Senior Agronomist, and W. A. R. COWDRY, Senior Experimentalist.

Studies were initiated in 1949 at the Ayr Regional Experiment Station in the "dry tropics" to determine the production of grass/legume pastures under irrigation.

The area experiences a definite wet season in the December to March period when approximately 76 per cent. of the average annual rainfall of 43·95 in. is received. The rainfall distribution and monthly temperatures are shown in Table 1.

The studies were made on typical soils of the delta of the Burdekin River. These alluvials are slightly undulating and though classified as sandy clay loams and silt loams they have relatively poor structure, especially when cultivated for a period without additions of organic matter. The soils are reasonably well supplied with plant foods other than nitrogen.

TABLE 1

CLIMATOLOGICAL DATA FOR AYR

Month	70 year Average to 1957 Rainfall Inches	30 Year Average to 1957	
		Screen Maximum °F	Screen Maximum °F
July	·86	77·0	53·1
August	·54	78·9	54·6
September	1·19	82·2	59·5
October	·84	85·2	64·7
November	1·64	87·9	68·8
December	4·08	89·6	71·7
January	11·31	89·6	72·9
February	10·78	88·8	72·5
March	7·39	87·6	70·1
April	2·64	86·1	66·4
May	1·31	82·3	60·6
June	1·37	78·2	56·6
	43·95		

Grazing Trial

An area of 25 acres was subdivided into 20 paddocks. Five pasture mixtures were used, with four plots of each mixture. Each paddock was grazed for 1 week and spelled for 3 weeks. Shade for stock was provided. Pastures of promising grasses and legumes were sown. The species and combinations were as follows:—

(i.) Rhodes grass + Townsville lucerne (later Rhodes + Stylo).
(ii.) Para grass + Clitoria.
(iii.) Para grass + Centro.
(iv.) Guinea grass + Phaseolus (later Guinea + Centro).
(v.) Guinea grass + Stylo.

After one year Phaseolus and Townsville lucerne were replaced by more suitable legumes, and later Clitoria, which was always weak, was replaced by invading centro. The four main pastures (i.), (iii.), (iv.) and (v.) were studied during the 1951-56 period.

The area was spray-irrigated, the schedule providing for applications of 2·3 in. of water per fortnight in winter and 3·0 in. per fortnight in summer, if these amounts were not received from rainfall.

Grazing commenced in 1950. Pasture production was determined by yield cuts taken before grazing and by hand separation of species. Nutrients were determined by chemical analyses.

The establishment of these pastures brought out some interesting findings which are summarised as follows:—

(i.) It is essential to provide a clean weed-free seed bed for pasture sowing.
(ii.) It is necessary to control grass growth by mowing or light grazing to prevent heavy shading of legumes and thus aid their development. Mowing will also check weed growth.
(iii.) High soil fertility is necessary for early pasture establishment, and applications of nitrogenous fertilizers are advantageous.

Irrigated Pasture Mixtures

Grazing management has an important bearing on the vigour and productivity of tropical pastures. In a previous article in the March issue of this Journal, details of stocking rates were described, and it was shown that the pastures carried approximately 1·2 beasts per acre during the least productive month of July and over 1·8 beasts per acre during highly productive February and March summer months. However, cattle weight gains were adversely affected during the hot, humid summer period. Peak weight gains of 70 lb. per acre per month were recorded during the cooler early summer months of October and November. Weight gains in the winter months, May to August, were approximately 30 lb. per acre per month.

Plate 2

Para Grass and Centro Pasture Formed an Attractive Pasture in June, but Vigour Was Greatly Increased in the Summer Period.

Para grass—*Brachiaria mutica;* Centro—*Centrosema pubescens;* Guinea grass—*Panicum maximum;* Stylo—*Stylosanthes gracilis;* Rhodes grass—*Chloris gayana;* Phaseolus—*Phaseolus lathyroides;* Clitoria—*Clitoria ternatea;* Townsville lucerne—*Stylosanthes sundaica.*

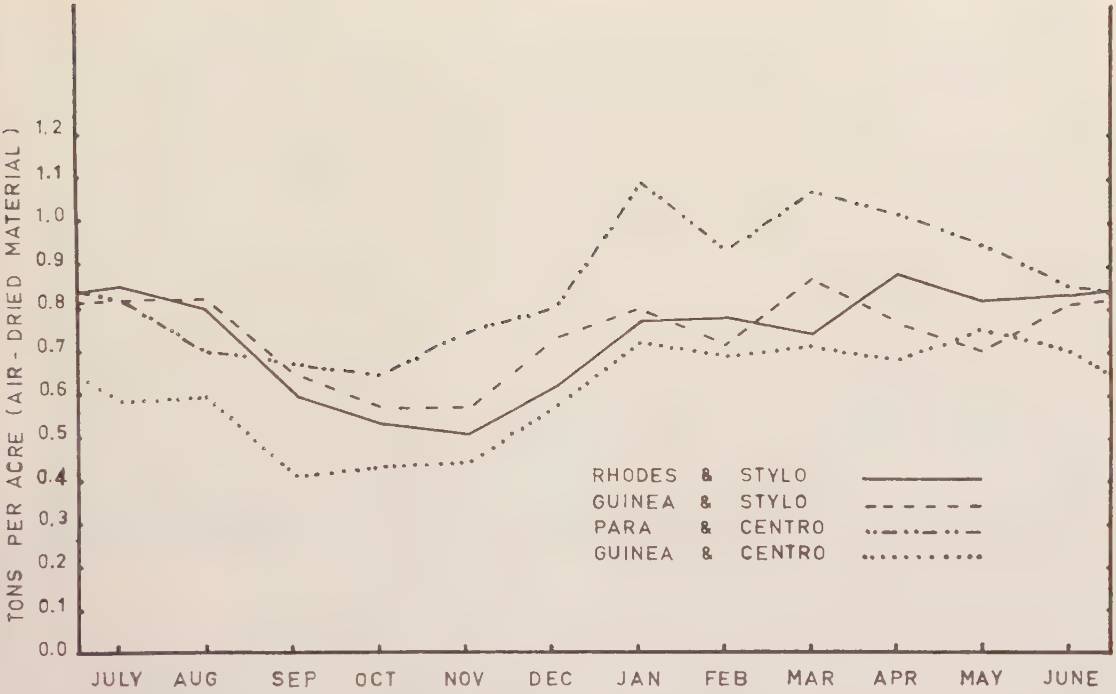


Plate 3

Average Monthly Weight of Available Forage (1951-1956).

Forage available for grazing was determined on a dry matter basis, the monthly average being determined from weekly samplings taken just before commencement of each grazing cycle.

In the first two years, availability of forage was high while stocking rates were maintained at below maximum levels. During the winter months the pasture had less than 0·5 tons per acre (dry matter) available for grazing, whereas in summer the areas carried over 1·0 tons per acre. With higher stocking rates and more intensive use of the pastures in later years, from 0·2 to 0·6 tons per acre of pasture (dry matter) was available for grazing at each grazing cycle.

The average monthly determinations of forage available for grazing have been shown in Plate 3 for the years 1951-56 during which the four main pastures were studied. Cattle were normally sold in July and new animals introduced in August or September. This would account for the greater amounts of available forage recorded in August.

The pattern of seasonal production of the mixtures is clearly shown, and as the grass species used have a pronounced summer growth pattern, there is an increase in available forage during the summer months. Production is well maintained during early winter but the decline in forage supply in August and September would be more marked in years when grazing was continued during that period. As cattle were sold in July or August the use of pasture was reduced in that period. However, entry of new animals after this period was reflected in a rapid decrease of the available forage during September and October, but the position quickly improved when new summer growth commenced in November.

The drop in production in late winter also coincided with a decline in palatability and nutritive value of some species and therefore the rate of consumption was probably reduced in winter and early spring.

Seasonal Growth Pattern of Species

In studying separate pasture mixtures the production of the main grass and legume components and weeds was measured. Total forage available

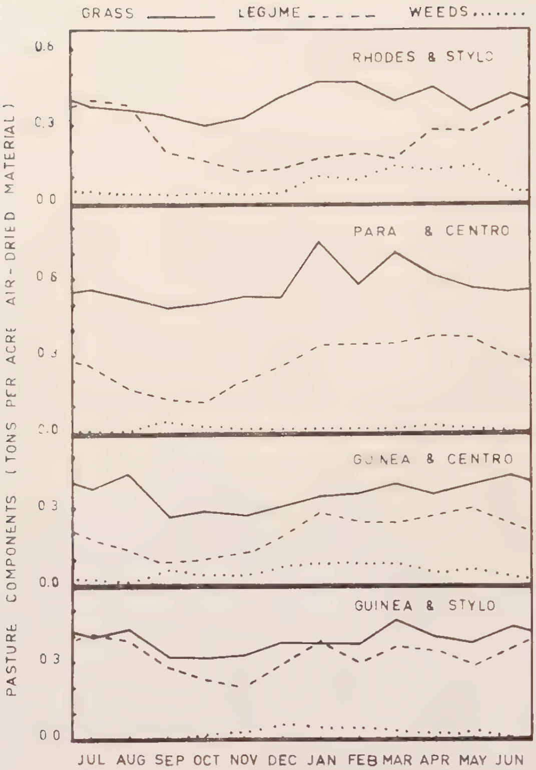


Plate 4

Average Monthly Yield of Components of Four Irrigated Pastures (1951-1956).

from these botanical separations is shown as monthly averages for the period 1951-56 in Plate 4.

Variations occurred from year to year dependent largely upon rates of stocking. The data shown indicate the average seasonal position under sound management and normal grazing intensities.

The contribution by the legume is of paramount importance. If satisfactory nodulation is obtained, species such as centro are capable of producing large quantities of nitrogen for use by the associated grass, and in addition the legumes are highly nutritious.

Every mixture used supplied the greatest quantity of available forage during the summer seasons. Stylo continued to produce well into the cooler months and Rhodes grass also maintained some growth during the winter.

Weed growth was of some consequence in the Rhodes grass/Stylo pasture.

The assessment of forage available does not indicate fully the growth pattern of the species. It was shown that Guinea and Para grasses commenced active growth when minimum temperatures rose above 60 deg. F. These conditions also held for centro, while stylo continued to produce into the autumn season.

Plate 5

Guinea Grass and Stylo Pasture in May, 1952.

Plate 6

Pasture of Rhodes Grass and Stylo in June, Showing Good Winter Growth.

The levels of productivity obtained in the final year, 1955-56, were maintained under similar stocking rates until 1959 and since then production has been satisfactory under different management methods as the pastures are being used in other livestock investigations.

Nutritive Value

The nutritive value of the pasture components was determined in the Para grass/Centro and Rhodes grass/Stylo mixtures at monthly intervals, excluding July, from April to December, 1955. Determinations were made on samples taken just prior to grazing. Average values are set out in Table 2.

TABLE 2

CHEMICAL COMPOSITION OF SPECIES

Component	Protein %	Fibre %	Phosphorus as P_2O_5%	Lime as CaO %	Ash %
Para grass . .	8·3	32·1	·86	·51	12·6
Rhodes grass . .	7·0	35·0	·61	·48	11·4
Centro	18·9	35·8	·73	1·46	11·1
Stylo	12·1	38·9	·76	1·40	9·3

The values for protein and lime in the centro and stylo indicate the high value of these leguminous plants for grazing animals.

Notes on Species

Rhodes Grass.—This grass in combination with stylo is outstanding during the early spring and early winter periods, and in winter time it forms an attractive grazing pasture. Summer production is inferior to Guinea and Para grass and continuing seed head development in summer necessitates frequent topping or mowing to prevent a marked decline in palatability.

In later years, centro was studied in combination with Rhodes grass but this mixture was not outstanding, the legume tending to dominate the grass for most of the year.

Para Grass.—This species proved to be the most productive during the summer wet season. It produces prolific succulent growth and in combination with centro forms a very vigorous pasture. If Para grass is overgrazed there is a marked reduction in subsequent ground cover and production. Close mowing can be equally harmful. Para grass is ideal for low-lying or wet areas.

Guinea Grass.—This species is capable of very high production and is more suitable for well-drained areas and light-textured soils. It combines well with climbing legumes and appears to benefit from association with centro. When grown with stylo, evidence of nitrogen shortage in the grass was apparent during the summer period.

Stylo.—This species has low palatability during the summer, and being semi-prostrate in growth habit, it is often overshaded by the tall grass species. It is well grazed in winter when partly "hayed off" and seeding, but its stems suffer damage from trampling by livestock moving between clumps of grasses.

Centro.—This legume proved valuable as a grazing plant and as a producer of nitrogen. It combined well with tropical grasses. Centro has a short dormant period in mild winters but it is severely damaged by frosts. It nodulates very freely in new plantings but its efficiency for producing nitrogen may decline after several years.

Clitoria.—This legume was sown in combination with Para grass in the original plantings. It was obvious by 1952 that it was not a suitable pasture legume. Clitoria was very palatable but it did not stand repeated or sustained grazing.

Townsville Lucerne.—This annual species was found to be unsuitable for use in irrigated pastures in combination with tall tropical grasses. Even with good seed germination the overshading by rapidly growing grasses prevented development and resulted in the disappearance of this legume.

Phasey Bean.—This species is not suitable for permanent irrigated pastures. Leaf is shed annually and the upright growth does not blend in with the tall grasses.

Elephant Grass.—Some of the newer strains have shown great promise in recent years. The species is capable of very heavy production and it is extremely palatable. Any surplus growth can be used for silage.

Setaria sphacelata.—This is an introduced grass which has some promise. Growth is very rapid but the tall thin stems can become rather rank if not grazed back or machine topped.

Plate 7

Observational Area of Elephant Grass and Centro Pasture 7 Weeks after Grazing.

Plate 8

The Introduction of Glycine into Para Grass Has Stimulated Grass Production and Pasture Vigour.

Glycine.—Some pastures of tropical grasses are showing greater benefit from glycine than from centro. Glycine is more frost-tolerant and it is capable of some winter production, while it is highly nutritious and more palatable than centro. It seems clear that glycine will have a major place in irrigated pasture mixtures in the northern areas.

Practical Considerations

Data have been presented to show the average productive capacity of irrigated tropical pastures for each month during the period 1951-56.

The seasonal growth of the species influenced the time required to fatten beef cattle. Although maximum production of pasture is obtained during the summer season and high stocking capacity is possible, liveweight gains of beef cattle were checked by climatic influences.

High temperature and high humidity have caused stress to English breeds resulting in less grazing and a lowered food intake. This topic was discussed by Mr. R. M. Larkin (see *Queensland Agricultural Journal* for February 1956).

With irrigation, high pasture production was continued over most of the year and very high stocking rates were maintained. However, the economics of production depend upon the availability and price of store cattle at the time pastures are most suitable for grazing, on the rate of gain as affected by climate, and on the final market price of fat cattle.

The breeding areas in the hinterland experience fodder shortages in the dry autumn to spring period. The use of irrigated coastal pastures to fatten stores readily available in this period offers promise, providing there is a realistic evaluation of the respective values of stores and fats.

Irrigated tropical pastures, if correctly watered and managed, are capable of fattening livestock in the dry season of the northern region and they offer scope for further development of the cattle industry in this section of the State.

Acknowledgements

Over the years many officers have been associated with these studies. The trials were originated by officers of C.S.I.R.O. who conducted the early work in 1949 and 1950, after which field studies were carried out by officers of the Department of Agriculture and Stock under the supervision of a committee consisting of members of both organisations.

Grateful acknowledgement is made for the assistance given by all associated with the work, especially Messrs. F. Kleinschmidt, T. G. Graham, B. L. Bartholomew, W. Pameijer, R. W. George, G. R. Littler, G. S. Daniels and F. H. Fletcher, each being locally responsible for sections of the programme at various times.

("Beef Gains From Irrigated Pastures In The Burdekin Delta" was published in the March Q.A.J.).

◆

Sowing Pastures In South-West Queensland

By R. G. WILSON, Adviser in Agriculture.

The success of sown pastures under the low, erratic rainfall experienced in south-western Queensland is largely dependent upon the use of adaptable plants, suitable soil type—its texture, structure, fertility—and favourable seasonal conditions assisted by methods of moisture conservation and pasture management.

The south-west lies within the 5 to 20 in. rainfall zone extending in the east from Dirranbandi and Augathella, westwards through the channel country to the South Australian and Northern Territory borders.

Weather data for a number of locations in the south-west have been calculated by the Bureau of Meteorology on a standard 30-year period from 1911 to 1940. These are shown in Table 1:—

TABLE 1

SOME WEATHER DATA FOR SOUTH-WEST QUEENSLAND

Station	Average Rainfall Points	October–March Summer Growing Period	April–September Winter Growing Period	Average Maximum Temperature	Average Minimum Temperature	Average Relative Humidity	Number Heavy Frosts 32°	Number Light Frosts 32° 36°
Windorah	1,005	658	347	86·8	59·6	38%	0·1	6·0
Thargomindah	913	541	372	83·0	58·9	38%	0·5	3·9
Quilpie	1,210	780	430	..	No record	..	..	..
Adavale	1,497	976	521	84·9	58·4	43%	1·9	11·7
Cunnamulla	1,262	750	512	82·0	57·1	46%	0·8	9·8
Charleville	1,938	1,275	663	84·6	56·1	41%	19·6	7·2
Augathella	2,044	1,391	653	..	No record	..	..	..
Morven	2,056	1,375	681	..	No record	..	..	..

Not only is the climate dry but the rainfall is erratic, and drought is a constant threat. Some two-thirds of the rain falls in the summer months from October to March. The wettest months are usually December, January, and February, while the driest months are August and September.

June is the most reliable month for winter rain. This aids winter herbage growth and often induces a green pick from sown pasture, especially from that growing on the lighter soils.

The summers are hot and the winters cold. Summer temperatures are often over 100 deg. F for prolonged periods, while July is the coldest month with a minimum of 40 deg. Frosts can be particularly severe under a typical blue sky and calm conditions. Though the top growth of sown pasture is damaged by these frosts, the

Plate 1

A Dense 6-Year-Old Stand of Gayndah Type Buffel on a Yapunyah-Sandalwood Flat of Light Grey-Brown Silty Clay Loam. This flat was mainly covered with galvanised burr 7 years ago.

whole plant is rarely killed. But on the heavier soils, some deaths and a lack of persistence may occur.

Evaporation, transpiration and rainfall run-off are high. These factors, combined with high temperatures during the summer growing season, constitute a serious hazard for sown pasture establishment, growth and persistence.

Run-off water is largely responsible for seasonal feed flushes on the very gently sloping, heavier soils of the channel country. Run-off water is now also being used by a few graziers in water-harvesting projects for the irrigation of fodder crops, sown grasses and legumes.

The main rain-bearing winds are the north-west monsoons. If they fail, then drought follows, often for prolonged periods. Then pasture establishment, growth, and spread are checked.

With drought, over-use of pastures occurs, decreasing the water intake when rains do fall, increasing soil erosion, and accentuating soil salinity problems in some areas.

Over the last 26 years, it is considered that the wet season would have permitted sown pastures to have been established at least 14 to 15 times, particularly in the 10 to 20 in. zone.

In view of the proven ability of some grass seeds to persist in the soil for 2 to 3 years during drought, the outlook for developing sown pastures in this region on suitable soil types is reasonably bright.

SOIL SUITABILITY

Sown pastures do well on a wide variety of soil types, but favour the light to medium textured soils such as sands, sandy loams, loams, silty loams and clay loams. A reasonably fertile soil with a loose topsoil over a moisture retentive clay loam is considered best. The lighter soils are largely timbered by mulga, cypress pine, carbeen or mulga and box and extend from St. George-Augathella west to Windorah and South to the New South Wales border.

Structure

The soils in most instances are of a poor structure, "crusting" on the surface to shed water rather than absorb it so as to benefit pasture seed germination and growth.

Fertility

The major soil deficiency is phosphorus. Some 90 per cent. of the soils successfully established to buffel grass under good soil moisture conditions are low in both nitrogen and phosphate and some are low in lime.

Apart from overcoming suspected copper deficiency and suspected cobalt deficiency on some of the more alkaline heavy clay soils, no worthwhile results from the use of micronutrients on grasses have been observed to date in this region.

Heavy Soils

Apart from a few stands established during the more favourable years of 1950-1956, buffel grass establishment and persistence have not been entirely satisfactory to date on the more moisture retentive, fertile heavy clays, such as the Mitchell—blue grass plains.

On denuded areas of these soils it is considered that over-seeding on trampled areas around water points, as well as on self-mulching or roughly ploughed areas is well worth the effort. Success, in most instances, would depend on good conditions with rains and cloudy days.

BASIC REQUIREMENTS

Some authorities quote soil fertility rather than soil texture as the determining factor in sown pasture establishment.

In practice, as indicated in Table 2, it would appear in a number of instances to be the reverse in south-west Queensland. Though soils adequately supplied in phosphate are desirable, it is evident from results in this district that the most adaptable sown pastures such as buffel grass are not so demanding in their soil fertility requirements as was first thought.

The more bulky grasses such as Biloela buffel, green panic and blue panic, usually show a marked response to fertilizer applications—provided that the stored soil moisture is capable of supporting the extra growth.

In practice, especially on the lighter, more droughty soils, fertilizer applications may do more harm than good. The untreated pasture though slower in establishment usually catches up in the first or second season—if the rainfall is adequate.

Maximum density bulk and regrowth occur on the moister silty clay loam drainage lines with reasonable reaction value and phosphate content.

Examples are seen in the Langlo River soils shown in Table 2, but buffel grows and also does well on a wide variety of other soil types.

Consequently, the basic establishment requirement is a suitable physical state, for example, a light to medium textured soil with a satisfactory structure and a reaction range from medium acid to near neutral, combined with a suitable soil temperature, and sufficient moisture to wet the subsoil and keep the surface soil damp. This will aid germination of pasture seed and its subsequent establishment.

Once the roots of the perennial buffel grass "tap" into the water table then under good management they usually survive long droughts, fire, heavy trampling and hard, close grazing indefinitely.

ADAPTABLE PLANTS

In keeping with the climate, the most adaptable sown pasture species are summer growers from semi-arid countries. The most successful so far are the buffel grasses. These are drought resistant, deep rooting and quite nutritious (See Table 5).

There are a number of strains, six being available commercially at present. They are Gayndah, American, Biloela, Cloncurry, West Australian, Molopo, plus a cousin Birdwood Grass. The first three appear the most promising types. Molopo and Biloela strains are more frost tolerant than the others.

West Australian, Birdwood, Gayndah and American are the most palatable types (Table 3).

It can be expected that other promising strains of this grass may be found. It is important that they should be adequately tested and proved before being put on the market, in order to prevent confusion through indiscriminate distribution of so-called varieties showing no real differences from those already in existence.

TABLE 2

Soil Type and Sown Pasture Suitability

Vegetation	Soil Texture and Colour	Reaction Value "pH"	Nitrogen	Phosphorus	Potassium	Comments
Mulga, Box, Wire grass (Charleville area)	Brown clay loam ..	5·2 to 6·0 (med. to strongly acid)	Low ..	Low (30–40 p.p.m.)	High ..	Good buffel 8 years old
Mulga, Bloodwood, Turkey Bush (Quilpie)	Red brown sandy loam	4·7 (very strongly acid)	Low ..	Low (38 p.p.m.)	High ..	Fairly good buffel. (2 years)
Hop, Butter, Ellangowan Bushes Gidyea, Mulga, Supple Jack (Quilpie–Eulo)	Orange to red brown fine sandy loam (sand ridge)	6·0 to 6·5 (med. to slight acid)	Medium ..	Low (40 p.p.m.)	High ..	Good buffel soil
Yapunyah Drainage Line (Langlo River)	Light grey brown silty clay loam	5·8 (med. acid) ..	Low ..	Fair (52 p.p.m.)	Very fair	Excellent buffel pastures—dense and bulky from 5–13 years of age
Poplar box, Sandalwood flat (Langlo River)	Red brown silty clay loam to yellow grey silty clay	6·7 (very slightly acid)	Low ..	Low (36 p.p.m.) to very high (213 p.p.m.)	Very fair to high	
Clay pans—odd Sandlewood (Langlo River)	Red brown silty clay loam to yellow grey silty clay	8·0 (alkaline) ..	Low ..	Very low (22 p.p.m.)	Medium	Buffel spreading over 5 years
Mixed gidyea, wilga, leopardwood, box, Sandalwood, Gilgai areas near Langlo River	Red brown silty clays and loams	7·7 to 8·0 (alkaline)	Medium ..	Fair (64–87 p.p.m.)	High ..	Excellent buffel, dense growth over 5 years
Cypress Pine, Wire grass Ridge (St. George–Dirranbandi)	Brown sand	6·0 to 7·0 (neutral)	Low ..	Low (24–30 p.p.m.)	Very fair	Very good buffel (6 to 10 years)
Leopard Wood, Mulga, Gidyea, Fringe (Quilpie)	Brown clay loam ..	5·8 (med. acid) ..	Low ..	Low	High ..	Suitable
Gidyea, Frontage Alluvials ..	Red brown clays ..	6·2 to 6·5	High ..	Fair (64–97 p.p.m.)	Fair to very fair	Most suitable
Spinifex odd stunted Mulga, Bloodwood	Orange to reddish brown loamy sand	5·0 to 5·9	Low to very low	Very low (18 p.p.m.)	Very low	Results indefinite (drought)
Mulga, Supple Jack, Whitewood—Red Sand Ridge (Channel Country, Windorah Area)	Light red-brown loamy fine sand	6·1 (med. acid) ..	Medium ..	Very fair (80 p.p.m.)	Very fair	Grows good Buffel—Needs wet season to start it
Mitchell—Blue Grass Plain (Cunnamulla) Gidyea–Coolibah Marginal areas	Heavy brown clay (sets on surface)	8·0 to 8·3 (med. alkaline)	Low to fair	High	High ..	Poor Buffel results
Mitchell—Flinders Grass Downs	Dark grey to brown clay (self-mulching)	7·8 (slightly alkaline)	Medium ..	High (118 p.p.m.)	High ..	Good buffel results (6 years)
Dense Gidyea Scrub	Grey to brown clays (loamy to self-mulching surface)	6·8 to 8·0 (neutral to med. alkaline)	Medium ..	High (116 p.p.m.)	High ..	Very good buffel (5 years)

Other plants contemplated or in use on a small scale under both raingrown and irrigated conditions are listed:

Blue panic	Very hardy tussocky, caney but palatable perennial.
Green panic	Palatable, rapid growing, tussocky perennial.
Natal grass	Palatable grass which grows readily on low fertility soils but is readily eaten out.

Paspalum	Palatable perennial useful along moist drainage lines.
Rhodes grass	A salt-tolerant, palatable perennial possibly useful for irrigated pastures with lucerne in this region.
Urochloa mozambicensis *Urochloa* sp.	Free seeding, often rooting at nodes; a perennial which is cut back by severe winters.
Weeping love grass	A free-seeding tussocky perennial; winter and drought hardy with marked differences in palatability between strains. One unpalatable strain could be a weed.
Bullamon lucerne	A deep-rooting, frost-susceptible native legume suited particularly to deep, sandy, river frontage soils.
Phasey bean	An annual or short-lived perennial, deep-rooting, susceptible to nematodes and bean fly. (C.S.I.R.O. is engaged in a promising breeding programme with this group of plants and new hybrids are now under test.)
Evening Primrose	Deep-rooting biennial winter herb suitable for deep sandy soils with pH of 6.0 and above.
Kapok bush	A deep-rooting perennial summer-growing herb; nutritious but often not readily taken by stock in Queensland.

TABLE 3

Species	Palatability	Grazing Season	Time and Rate of Sowing	Soils	Comments
Buffel Strains (Perennials)— (1) Gayndah (semi-prostrate)	Fairly high more palatable than Molopo, Cloncurry and Biloela	Once established is drought resistant; stands hard, close grazing, fire and trampling. Spring to autumn growth. Stand-over winter feed, seed. Spreads in good seasons	October to April. Pref. Jan. to Feb. 1 to 6 lb. Average 2 lb. per acre	Wide soil range—sands to clay loams	Medium height, leafy, yields well for seed, hay. Slow maturing. At times slow to establish. Is the major grass used. Better wind dispersal
(2) American (More upright)	As above	As above	As above	Wide soil range, less demanding on soil fertility than Biloela	More bulky than Gayndah. Early seeding. Easy to strike. Yields well for seed, hay. Slightly better frost tolerance
(3) West Australian (a short grass, fine stems)	High, most digestible	As above	As above	Wide soil range. Best growth on more fertile, moister soils	Lacks the bulk and vigour of Gayndah, American, Biloela. Sweetest grass. Heavy seeder. Takes less moisture than others; may hold better in drier areas
(4) Biloela (giant, tussocky type)	Medium	Once established is drought resistant, stands hard, close grazing, fire, trampling. Spring to autumn growth. Stand-over winter feed, seed. Spreads in good seasons	October to April. Pref. Jan. to Feb. 1 to 6 lb. Average 2 lb. per acre	Wide soil range. Does better on clays than above	Tall, coarse stems, blue leaf. Easy to strike. Seeds well. Short underground runners suit cattle areas. Somewhat frost-tolerant
(5) Molopo (medium height)	Medium	As above	As above	As above Greater clay soil tolerance	Strong underground runners. More frost-tolerant than Biloela. Blue leafed. Fine seeds. Seed supply scarce
(6) Cloncurry	Medium	As above	As above	Sands to clay loams	Not as palatable or as bulky as Gayndah. Strikes well. Heavy seeder. Grows well on rich deep alluvials
(7) Birdwood Grass (short grass)	Fairly high	As above	As above	Sands to clay loams. Better clay soil use than some	Short. Lacks vigour and bulk of Gayndah. Stiff seed awns. Uses less water to grow. Does not spread readily in most areas

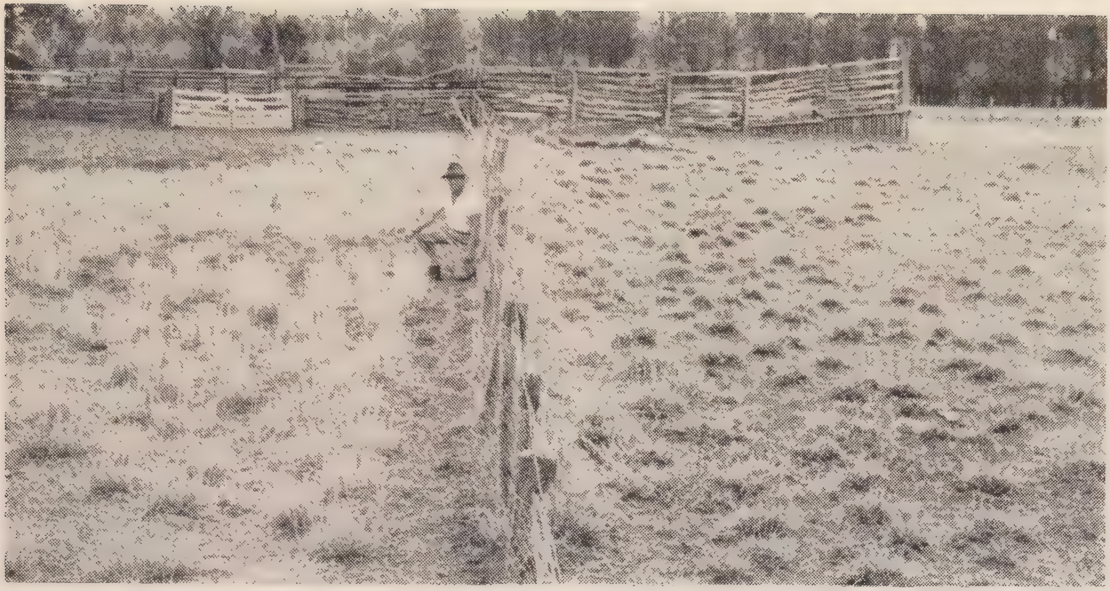


Plate 2

Gayndah Type Buffel Spreading Naturally Around Stockyards at "Maruga," on the Langlo River, North-West of Charleville.

It will be seen that no really satisfactory pasture legumes have yet been found for this region. To make matters more difficult there are no commercial seed supplies of Bullamon lucerne.

Supplementary raingrown pastures consisting of lucerne, sorghums (Sudan, *Sorghum almum,* grain sorghum and sweet sorghums) and oat varieties are largely confined to the more fertile, moister, clay and clay loam soils of the 18 to 20 in. zone to the east.

Irrigated species may include those listed for supplementary pastures plus such saline-tolerant or semi-tolerant grasses as Rhodes, kikuyu, couch (along the bore drains), rye grasses, Makarikari, green and blue panic grasses, African star grass and buffel grass. Possible legumes include strawberry clover, sweet clover (Bokhara, &c.), sweet lupins, medics (snail, barrel, &c.) and certain other clovers (such as Rose, Berseem, Ladino and Louisiana white), Bullamon lucerne and phasey bean.

The growth habit of each plant varies with the soil and climate, for example, buffel grass prefers the lighter soils and may grow to 3 or 4 ft. in a flush season and only 1 ft. in a dry year.

ESTABLISHMENT

Because the buffel grasses are considered the most suitable sown pasture species for the district the following information is given with particular reference to these grasses:

Good seed, free of noxious weeds is a primary requirement. Fresh seed may be only 2 per cent. viable, but if stored until next season the germination value may range from 30 to 80 per cent., depending a lot on the time and method of harvest and storage. Some 15 to 40 lb. per acre are usually harvested with home-made equipment. Some stands will yield over 120 lb. per acre.

Rate Per Acre

Usual planting rate is 2 lb. to the acre and this is equivalent to 4 to 6 seeds per sq. ft. Special areas, for example, "hobby plots" are usually seeded at 6 lb. per acre. For large-scale aerial seeding in the ashes of gidyea burns, the rate may vary from ¼ to ½ lb. per acre.

Some growers with a cheap home-grown seed supply prefer to sow more heavily at 4 to 8 lb. per acre, but this is uneconomical where seed is bought.

Plate 3

Buffel Grass Spreading Into Turkey Bush on a Hard Red-Brown Clay Loam Ridge.

Seed pelleting has not proved entirely satisfactory to date and trials are continuing with this method of establishment.

Planting Depth

Only a very light soil cover is required—¼ in. to ½ in. or so—and the seed may be covered by chains, harrows, brush or trampling. If the seedbed is very rough, the seed is covered by the action of the soil weathering over it. In some areas a "fallow" period (to build-up soil moisture and plant food) is allowed prior to seeding.

Ants

Seed harvesting ants may be most active, especially in the autumn. Seed treatments are being tested in detailed trials but in the meantime the use of 10 per cent. wettable powder BHC applied as a dry seed dressing at the rate of 3 oz. per bushel is suggested.

Time of Seeding

Preferably, planting should coincide with the wet season—October to March. Generally late January to early February is favoured. The seed is usually sown dry.

If seasonal conditions are not suitable buffel seed has been known to lie-over for at least 3 years in the soil—a valuable factor indeed in a dry climate with an erratic rainfall.

Where good subsoil moisture has been built up by unusually good winter rain, then early spring seeding, before the summer heat prevails, would be in order.

On soils that crust on the surface, a rough cultivation and seeding in the one operation just before the wet season is desirable.

PLANTING METHODS

Planting methods must provide conditions favourable for germination and plant growth.

The chances of survival would depend largely on the following major points:

(*a*) Choose sites where soil moisture, texture and topography are favourable, and make the soil receptive to rainfall by cultivation, ripping, root-ploughing, discing, mouldboard-ploughing. Moist (not waterlogged) depressions, drainage lines, lower slopes as they merge into the heavier soils, mulched areas under fallen branches, and slopes ploughed on the contour are also suitable.

(*b*) Other suitable areas for planting are those which have been denuded of the original vegetation, such as over-stocked and eaten-out drainage lines; creek and river frontages, naturally flooded areas, watering points and stockyards where trampling occurs. Checker-board ploughing of clay pans with root ploughs, heavy discs or mouldboard ploughs will leave the soil rough and high and prolong the period of receptivity to water intake.

(*c*) The removal of inedible shrubs, such as turkey bush, which compete for moisture is an advantage. The root—or disc—plough can be used in the one operation to form a rough seedbed receptive to rain and seed.

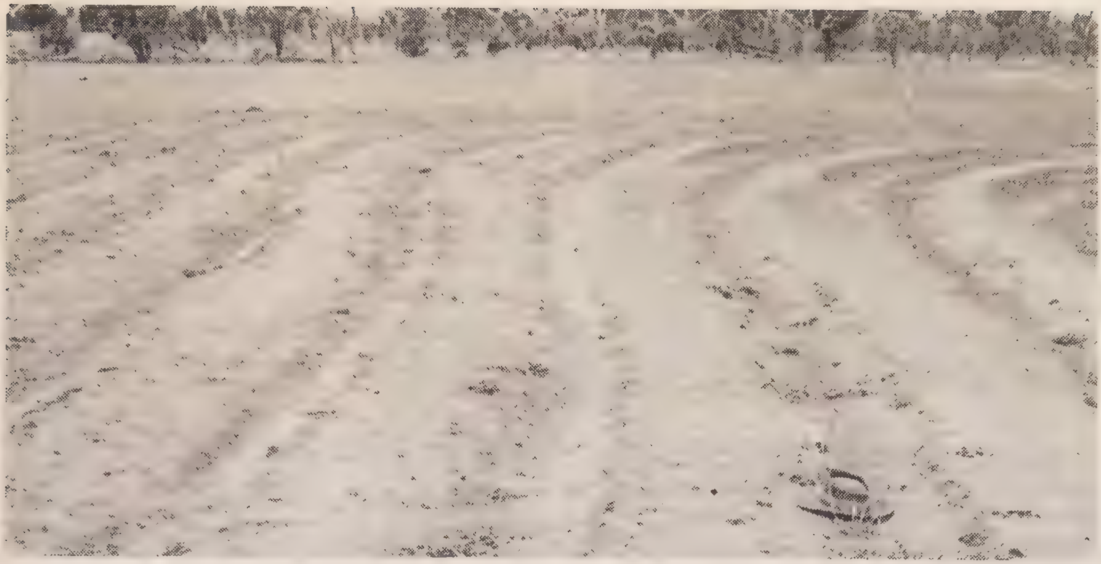


Plate 4

Buffel Grass Establishing in Ploughed Furrows on a Red-Brown Clay Pan on "Maruga," North-West of Charleville.

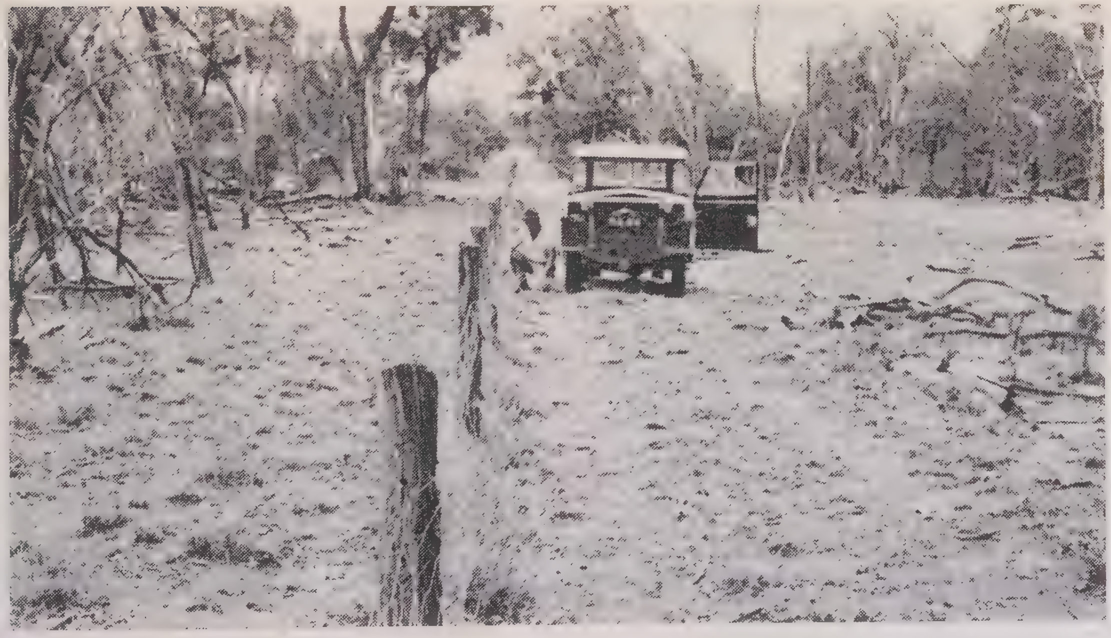


Plate 5

Gayndah Type Buffel Grass Broadcast August, 1956, Spreading in Mixed Gidyea, Wilga, Box Country, North-West of Charleville.

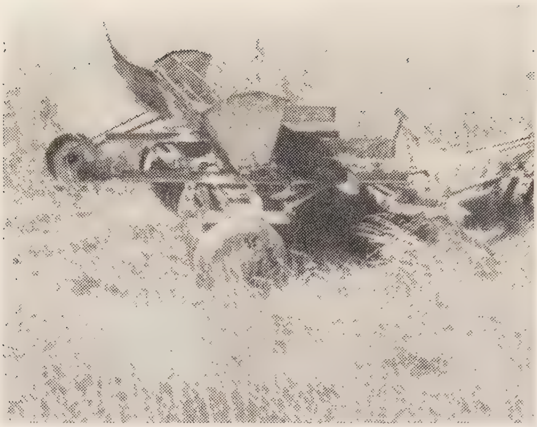


Plate 6

A Seed Box Modified to Plant Buffel Grass on "Oinmurra" Dirranbandi. Later equipment includes rollers to consolidate this loose soil now carrying wire grass.

As edible trees such as mulga are pushed to feed stock during drought, seed of suitable grass strains such as buffel can be broadcast into the area.

(*d*) Use suitable equipment—root and disc ploughs, rippers, sheep-foot rollers. A seedbox attachment or exhaust seeder aids better seed distribution and ensures a constant rate per acre.

Strip seeding of large areas in strips ½ to 1 chain apart is also used where it is known the grass will spread. Using cheap home-grown seed, some graziers prefer to clear and seed-down solid areas rather than strip-seed as they claim that stock and marsupials trample, over-graze and camp on the strips and neglect the native grasses. This decreases plant vigour and hinders spread.

Soil renovation aids old and new stands by breaking the soil crust and so letting in water, spreading seed and thus helping to thicken up the stand.

Should no equipment be available for sowing then use the stock to trample the area before and after broadcasting the seed. Scatter seed on self-muching soils and around trampled areas such as watering points and stockyards; seed water edges also, the surface water of pools and streams especially prior to rains.

Other good places for broadcasting seed are at the base of such trees as box, turpentine and cypress pine, or under galvanised and noogoora burr bushes.

Stock camps and along netted fence lines where stock traffic is heavy are also good broadcasting sites.

In those instances where buffel grass hay has been cut when in seed, this could be fed out in areas where it is desired to establish the grass by natural spread.

If seed is scarce and labour plentiful it may be possible to plant out root divisions in moist drainage lines and along stream banks (these may need a netted guard) since water is a means to rapid spread of seed during stream rises.

Stock can be used to spread the seed. Horses are good in this regard while seed may be spread on the backs of yarded sheep which distribute it as they go back into the paddock. This should be done only in areas where it is known the grass will spread naturally.

WILL IMPROVED PASTURES GROW ON MY PROPERTY?

Use the "hobby plot" method, if you are not sure of the pasture species that will suit your soils. It is easy to establish a cheap, simple "hobby plot" as illustrated in Table 4. Such

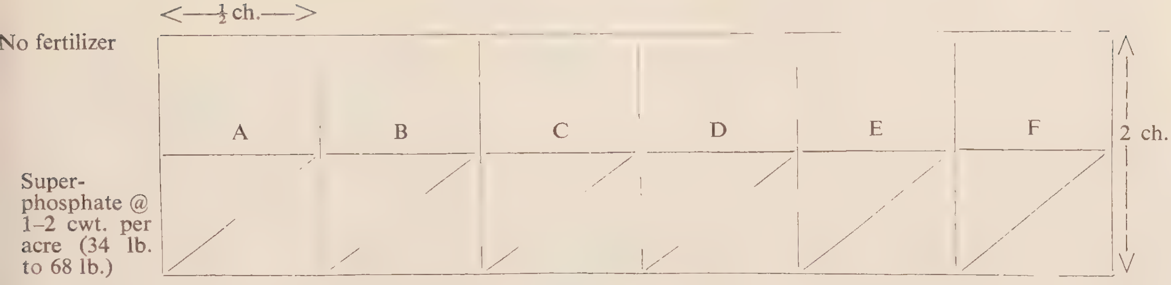
Plate 7

Establishment and Vigorous Growth of Gayndah Buffel Broadcast into Fallen Mulga Branches on Hard Country on "Maybe", Quilpie.

TABLE 4

A Simple Pasture "Hobby" Block (One-tenth acre plots)

(There are a number of variations to suit requirements)



plots are fun. Simple in layout, they provide a wealth of information and cheap seed. The area should be fenced off to avoid over-grazing.

Above all have patience; a good season is everything. The years 1950-56 were good for this work. Some obtained results in the first season, others in 2 or 3 years; in odd cases it may be up to 7 years before a stand is satisfactorily established.

A=Birdwood Grass at 6lb./acre (10 oz.)
B=Gayndah buffel at 6 lb./acre (10 oz.)
C=West Australian buffel at 6 lb./acre (10 oz.)
D=Biloela buffel at 6 lb./acre (10 oz.)
E=Concurry buffel at 6 lb./acre (10 oz.)
F=American buffel at 6 lb./acre (10 oz.)

Method

1. Plough, rip, disc, or otherwise cultivate the area and leave it as rough as possible prior to the wet season. This aids deep rainfall penetration.

2. Peg out the plots.

3. Apply the superphosphate broadcast as per plan.

4. Broadcast the various buffel grass seeds on to their respective plots. A very light soil cover with a chain, harrows or leafy branch will suffice—the rest is up to a favourable season and a deeply moistened soil with follow-up rain should ensure establishment.

5. Fence the acre—such small areas are prone o over-stocking. Controlled grazing plus a seed harvest is made possible by a fence.

PASTURE MANAGEMENT—A MUST

Water is considered the greatest limiting factor in plant establishment and growth in the south west. Consequently, all practical means should be used to improve the supply of water in the soil or at least economise on its use.

The cheapest way to hold water and soil, maintain fertility and pasture vigour (this applies to native pastures too) is by efficient grazing management. For example, a closely grazed pasture has been known to shed 70 per cent. of high intensity storm rain as run-off whereas a moderately grazed pasture may lose only a small amount as run-off and even less if renovated with a ripper or subsoiler in May and/or early Spring, preferably the latter.

Plate 8

American Buffel Growing Strongly on Acid, Low Phosphate Soil following Discing on "Green Mulla," Quilpie.

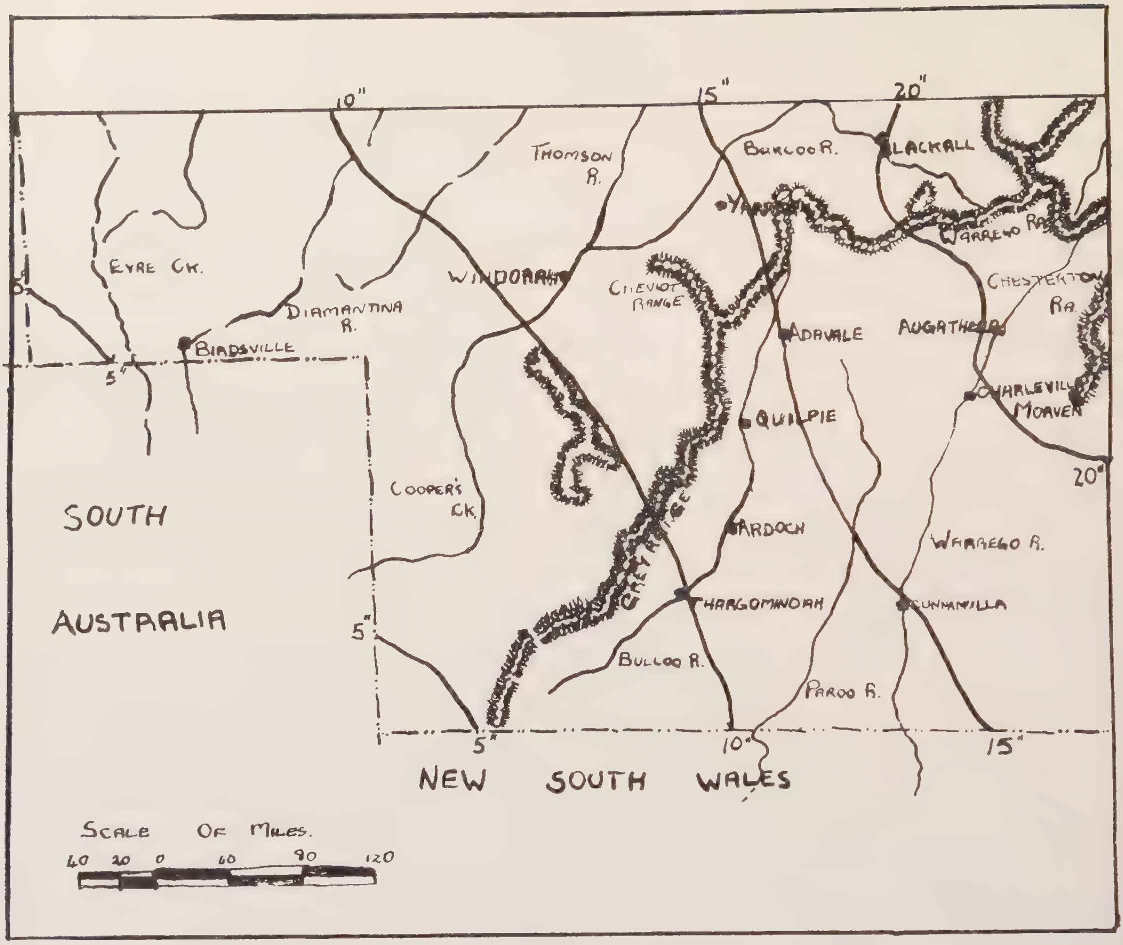

10"
15"
20"
THOMSON R.
BARCOO R.
LACKALL
YARAKA
WARREGO RA.
EYRE CK.
WINDORAH
CHEVIOT RANGE
DIAMANTINA R.
BIRDSVILLE
5"
ADAVALE
AUGATHELLA
CHESTERTON RA.
CHARLEVILLE
MORVEN
QUILPIE
20"
SOUTH
AUSTRALIA
COOPER'S CK.
GREY RANGE
ARDOCH
WARREGO R.
THARGOMINDAH
CUNNAMULLA
5"
BULLOO R.
PAROO R.
5"
10"
15"
NEW SOUTH WALES
SCALE OF MILES.
40 20 0 40 80 120

Plate 9

Map of South West Queensland, Showing Isohyets.

It is considered that on germination the pasture should be allowed to become well established by letting the plants get their roots down deep and set seed by giving them grazing protection for 12 months or at least until the plants have seeded or are seeding down. Kangaroo invasion of course has to be contended with; at least they will present themselves for mass extermination on the sown areas.

In the second and third year it is preferable to protect the established pasture until after seedfall or partial harvest and then use its standing feed as a winter standby. Graze it down; not too closely (leave 30 to 40 per cent. if possible) before taking the stock off on the onset of the first good spring or summer rain. Of course these rules go by the board in the face of drought.

During grazing, especially on the softer soils such as the spinifex, cypress pine, carbean, beef wood, ironwood, supple jack and belah country, stock aid the spread and trample in the seed.

Once a sizeable area is built up which is still only a small portion of the total property, a system of deferred rotational grazing appears best adapted to sown pastures in the south-west. The system is to spell one paddock in full growth annually every third year. This controls grazing, thereby increasing plant vigour and seeding and also provides winter and drought standby feed. The remaining paddocks are rotated to keep them fairly short and green in order to increase their nutritive value.

A changeover from sheep to cattle also usually benefits pasture vigour and rehabilitation.

TABLE 5

A Few Analyses of Water–Free Material
(Agricultural Chemist)

—	Crude Protein	Crude Fat	Carbo-Hydrate	Crude Fibre	Calcium	Phosphorus
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Buffel Grass—						
(*a*) Young and Leafy	18·0	1·6	41	27·0	0·95	0·67
(*b*) Stemmy, leafy in full, ripe seed	8·3	0·8	44	38·5	0·27	0·157
(*c*) Old, stemmy growth	5·6	1·2	52	30·4	0·25	0·154
Blue Panic—						
(*a*) Young leafy growth	19·2	1·9	. .	19·5	0·542	0·365
(*b*) Stemmy growth	6·2	0·7	. .	30·4	0·347	0·476
Green Panic—						
(*a*) Young growth	12·0	1·42	48·58	27·5	0·74	0·64
(*b*) Old growth	3·4	. .	. .	. .	0·43	0·63
Wire Grass (*Aristida* sp.)—						
(*a*) Young	8·0	. .	38·0	25·0	0·50	0·4
(*b*) Old	1·0	. .	55·0	38·0	0·2	0·19
Lucerne—						
(*a*) Young and leafy	29·4	1·2	. .	17·0	1·98	1·0
(*b*) Old and mature	18·4	1·2	. .	32·6	2·54	0·68
Phasey Bean—						
(*a*) Near maturity	22·8	2·7	36·6	28·0	2·77	1·0

NUTRITIVE VALUES

The improved nutritive value of sown pastures is most marked. The sown species, especially the buffel grasses, hold their nutritive value well, so that stock fatten quicker and carry better, and returns per acre or square mile are greater.

Some graziers with a decade of experience find that buffel grass holds stock better than Mitchell grass; in their experience 2 to 3 times better.

My observations show that in comparison with the native grasses growing on the lighter soils, buffel grass is from 4 to 12 times better. For example, in the Bollon area, with only 8 in. of total rain over a 12-month period, low fertility brown sandy soils rated at one sheep to 5 or 6 acres under native pastures were carrying in good condition 1 to over 1½ sheep per acre on buffel grass.

This soil type carries mostly cypress pine. Based on average values from three properties, this soil has a pH value of 6.0 to 6.8 with low nitrogen and phosphorus levels and very fair potash.

One reason for this difference in carrying capacity is the superior nutritive value and digestibility of these sown pasture species. Some differences in chemical composition are shown in Table 5.

Sown pastures in the young stage as shown in Table 5 are suitable for breeding ewes and milking cows. At the leafy, full seed stage they are suitable for wether maintenance, wool growing and cattle fattening.

Dry growth of buffel grass rarely seems to fall below 5 per cent. crude protein in this region and is consequently a stock maintenance feed many times better than wire grass (*Aristida* sp.). The feed value of dry feed is of course enhanced by the winter herbage, salt-bushes, mulga, nettle and so on which occurs under favourable conditions of soil or weather in this region of Queensland.

Brian Pastures Field Day

Following is a precis of the morning's session at the Brian Pastures Field Day on April 11 (afternoon session on p. 243):

Sown Grass and Legume Strains.—Over the past 6 years, a few hundred introductions of pasture strains have been grown at Brian Pastures. Some of the more promising strains are found in the two sward trials demonstrated, both of which were sown in February, 1960.

(*a*) Makarikari grass selected for its winter tolerance and hardiness yielded in late January 3,830 lb. dry weight per acre compared with 2,150 lb. per acre from green panic. The Makarikari swards contain more legumes than the green panic. Both grasses were established from seed.

Glycine is one of the more drought and frost tolerant tropical legumes, but lucerne has outyielded it in the first year.

(*b*) In the second trial, two strains of Columbus grass (*Sorghum almum*) yielded almost as well as sweet Sudan grass in the first season and initially outyielded green panic and elephant grass. They have since suffered acutely from leaf streak and nitrogen deficiency. Of the swards demonstrated, elephant grass has the best legume mixture.

Eye Cancer in Cattle.—Eye cancer has been a continual cause of economic loss in Hereford cattle. It is usually characterised by lesions in the eye or eyelid in older cattle. If not surgically removed, the cancer continues to grow, eventually causing the death or destruction of the animal.

This condition occurs more frequently in tropical and sub-tropical areas than in the temperate areas.

The Department is undertaking an investigation into this condition on a number of properties in Queensland. Detailed studies are being undertaken on Brian Pastures in order to test the inheritance of the condition while its incidence is being examined on a number of commercial properties. It is hoped these studies will yield information leading to effective control measures.

Pasture Management Studies.—The object of this series of studies is to understand better how pastures react to different degrees of use in order that maximum animal returns may be obtained. The experiments have been so far concerned with removing different quantities of plant growth with different frequencies and times of removal. This year the work will be expanded to embrace full-scale grazing trials using different rates of stocking on native pasture and on green panic-lucerne pastures, and pasture conservation.

The importance of three ideas which have been put forward as determining how much growth a pasture makes after it has been grazed or mown is being assessed. These are—(*a*) The amount of leaf left on the pasture; (*b*) The amount of energy reserves held in the roots and stem bases; (*c*) The stage of growth in relation to flowering at which pasture plants are defoliated. Some data on the effect of differing severity of defoliation on nitrogen uptake and nodule growth of tropical legumes was presented.

Sown Pasture Productivity.—The object of this trial is to compare three sown pasture mixtures. These are Rhodes, green panic and buffel grasses, each with lucerne and phasey bean. The trial was sown in 1954; grazing commenced in January, 1955. The sowing rate was: grass 5 lb./acre, lucerne 1 lb./acre, phasey bean 6 oz./acre. Stocking has been rotational with 2 weeks' grazing followed by 8 weeks' spell at one adult beast per 4 acres.

Lucerne persisted for 5 years and was largely responsible for arresting the normal seasonal annual live weight loss. Grazing was interrupted during 1960 when the area was chisel ploughed twice and the lucerne oversown at 1 lb./acre. The persistence of both green panic and buffel has been superior to Rhodes grass.

The following table shows animal production. Results for native pasture are obtained from similar aged steers grazing native pasture at half the stocking intensity under normal station management.

WEIGHT CHANGES FOR SEVEN GROUPS TURNED OFF THE TRIAL

(Expressed as lb./liveweight per acre)

Group	Period	Rhodes Grass Mixture	Green Panic Mixture	Buffel Grass Mixture	Native Pasture
1	7- 1-55 to 20- 1-56	112	116	122	37
2	20- 1-56 to 11- 5-56	40	34	43	13
3	11- 5-56 to 14- 9-56	23	33	34	8
4	14- 9-56 to 22-11-57	51	93	83	25
5	22-11-57 to 15- 8-58	50	65	74	41
6	15- 8-58 to 14- 8-59	73	78	73	39
7	14- 8-59 to 29- 1-60	50	54	40	30
	Total . .	399	473	469	177

Progress Results On Wild Oat Control

By S. R. KLOSE, Adviser In Agriculture.

The chemical, "Avadex", proved highly successful in trials on the Darling Downs last season, with wild oats selectively controlled in linseed, barley and wheat. At this stage, however, a cautious approach to the use of the chemical in wheat and barley is recommended. Further trials are to be made this year and growers will be advised of results.

In the cereal growing areas of Queensland, the wild oat is considered to be the worst weed, and its spread is the concern of everyone engaged in grain growing. Its persistence has defied all efforts by scientists to evolve a satisfactory method of control.

Two characteristics have aided wild oats. The seeds are shed when ripe, and are capable of lying dormant in the soil for many years. Wild oats invariably ripen before the crop in which they are growing is ready for harvest, hence ample seed is scattered on the soil. The wild oats seed is loosely held and even when the crop is cut for hay, some seed is left in the field.

Many grain growers in Queensland have stated that they could be forced out of wheat and linseed production through the unchecked spread of wild oats.

A linseed grower of the Millmerran district has estimated that wild oats have reduced his yield by up to 50 per cent. On inspection of the property, this was found to be an understatement.

In the last few years, wild oats have been particularly troublesome. This condition has been aggravated by the absence of autumn and early winter rains, which usually produce a first crop of wild oats which can be destroyed by cultivation.

When the season breaks late, the crops are planted as soon as the conditions allow because there is no guarantee of further planting rains, and the wild oats then germinate with the crop and further control by tillage is not possible.

The absence of livestock on many Darling Downs grain farms is another reason for the upsurge of the wild oat problem.

Pre-emergence Spray

"Avadex" is a pre-emergence spray. That is to say, the spray is applied to the soil before seeding. The wild oat absorbs the chemical in the top layer of soil and is controlled or destroyed as it germinates and commences growth.

To be effective, the spray must be mixed thoroughly in the top few inches of soil the same day it is applied.

Crop seeding may be delayed for up to 3 weeks after application.

The delay in seeding is not recommended, the aim being to give the crop maximum protection and thus allow the crop to compete with later germination of any wild oats.

For the present, this recommendation refers to linseed only.

Problems

The overseas recommendations for incorporation or mixing of the "Avadex" in the top soil by two workings with a disc implement were unacceptable for two reasons. Disc implements are not in general use on the Darling Downs. Two workings mean double the cost, and most important, the chance of losing a planting rain.

The last point needs no further comment in Queensland where autumn and winter rains are unreliable, and all too often absent when most desired.

It was considered that the Australian seeding combine, which is unique to this country, would, with the four rows of cultivating tines, give the necessary stirring of the top soil. Further, the combine is used for seeding the crop and this double working was considered ample to give the desired mixing of "Avadex" in the top soil.

The overseas drills, with either the disc or the boot which opens up the row for the seed, do not stir the soil in the same way as our combine seeder.

Wild Oat Species

All overseas investigations have been made on one species of wild oat, *Avena fatua.*

It was known that another species, *Avena ludoviciana,* was present on the Darling Downs, and this was considered to be the dominant species.

Surveys in two districts (Millmerran and Jondaryan) were made with a botanist, to determine the prevalence of these species.

Avena ludoviciana is the dominant species, according to these surveys.

A pot trial was also carried out in a glasshouse to get factual evidence on the effect of "Avadex" on this species.

Applying the Spray

The conventional boom spray, which is in common use for controlling weeds with 2,4-D was used to apply the chemical. The spray volume was 10 gal. to the acre, using a flat fan nozzle at 30 lb. pressure.

Accurate application of "Avadex" is a most important factor in controlling wild oats, particularly in the cereals, wheat and barley.

To meet this requirement, growers will need to equip their spray outfits with reliable spray nozzles and pressure gauges.

The flat fan Monarch type nozzle is recommended. A spraying pressure of between 30 and 40 lb. should be used. A higher pressure will cause fogging and drift of the spray, and consequently uneven distribution.

Darling Downs Trials

Growers may be interested in the details of the trials which last season proved to be so spectacular in controlling wild oats. Wild oats in linseed is a more urgent problem than in wheat or barley because the linseed does not provide much competition to the growth of wild oats. This was the reason for selecting linseed for our first trial with "Avadex".

The trials were designed to test "Avadex" on a field scale, employing equipment and implements normally used by grain growers.

Linseed Trial

The conventional 5 x 4 randomised plot layout was used in the linseed trial.

In addition to the check, or controlled plot, four rates of "Avadex" were applied, being 1 lb., 1½ lb., 2 lb. and 2½ lb. of active ingredient to the acre. These treatments were applied in each of four blocks. A buffer plot of Prior barley separated each plot to account for any possible spray drift.

Each plot was sprayed with the appropriate rate as per plan. The whole area was then worked with a combine within 24 hours to mix the spray into the top soil.

The plots were then sown with the Walsh variety of linseed and wild oats the same day. The barley buffer strips were then sown to complete the trial.

To ensure an adequate and even stand of wild oats, it was decided to plant seed and not rely on volunteer germination of wild oats.

The wild oat seed was carefully sampled, so that we could have it tested for germination and for the percentage of each species present in the seed sown.

Check—Wild Oat Plants per Foot of Row	Linseed 7½	Wheat 4½	Barley 4
	1 Plant to—	1 Plant to—	1 Plant to—
1 lb. "Avadex"/acre	3 ft. of row	2 ft. of row	2 ft. of row
1½ lb. "Avadex"/acre	9 ft. of row	3 ft. of row	3 ft. of row
2 lb. "Avadex"/acre	9 ft. of row	15 ft. of row	16 ft. of row
2½ lb. "Avadex"/acre	8 ft. of row	Not included because of shortage of "Avadex."	8 ft. of row

Another point of interest here was the fact that Prior barley was a contaminant in the wild oat seed used. This barley was deliberately left in the sample to gain some early information on the effect of "Avadex" on barley.

The observations made in this trial led to the decision to establish further trials on both wheat and barley later in the season.

Wheat and Barley Trials

Unfortunately, the only land available at short notice so late in the season for these trials had summer crops earlier this year, and naturally soil preparation was incomplete.

The Festival variety was selected for the wheat trial, and this was sown on land which had previously grown sunflowers.

The Prior barley trial was sown on the area which carried the first Queensland hybrid sorghum trial.

Wild oat seed was again planted, and the percentage and germination of each species were determined.

The method used in planting these two trials was changed. The wild oats and the wheat or barley were sown in alternate rows through the combine. This means we had, in the case of wheat, a row of wild oats then a row of wheat. This greatly simplified the counting of the plants of both the wheat and wild oats.

The effect proved most striking in the appearance of the sprayed and check plots after germination. In the "Avadex" sprayed plots, the row spacing was 14 in. with the non-appearance of the wild oats.

We were indeed fortunate in securing an excellent germination of wild oats in the three trials.

The latest report of experimental work in America indicates that delayed seeding after the application of "Avadex" may reduce the thinning of the stand of wheat and barley.

Within a few days after germination in the linseed trial, the check plots not sprayed were clearly visible. The wild oats germinated freely in the check plots, giving the trial area a checkerboard effect.

In the wheat and barley trials, the early visual effect of "Avadex" was also spectacular. The sprayed plots could be detected easily. The drill rows were wider spaced, because the wild oats sown in alternate rows failed to germinate. By contrast, the unsprayed plots showed the normal 7 in. spacing of rows.

"Avadex" delayed by several days the germination of the linseed, and at flowering all sprayed plots were several days later.

Wheat and barley were delayed a few days in ripening.

EFFECT OF "AVADEX"

——	Linseed	Wheat	Barley
	Plants per foot of row	Plants per foot of row	Plants per foot of row
Check	12	9	7½
1 lb. "Avadex"/acre	10	6½	5¼
1½ lb. "Avadex"/acre	9	6	4
2 lb. "Avadex"/acre	9	3¾	2½
2½ lb. "Avadex"/acre	8½	Not in trial due to shortage of "Avadex."	2½

The standard method of counting the plants of the crop seedlings and the wild oats was employed to get accurate information on the control achieved by the "Avadex".

We made ten 6 ft. counts on each plot in the three trials. This gave us 240 ft. of 7 in. row for each rate of application.

These figures graphically illustrate the remarkable control "Avadex" had on the wild oats and, at the same time, what effect we could expect on the crop.

This information is vital to a decision on the best and most economical rate of application, and whether the crop in question is sufficiently resistant to "Avadex".

Wild Oat Control

The figures quoted are the average number of wild oat plants per foot of 7 in. row for each rate of application used.

The figures quoted are to the nearest whole number.

The control of wild oats in the three trials shows a similar pattern. The rougher surface and the incomplete soil preparation in the wheat and barley trials may be a valuable lead to what influence soil type could have on the technique required for mixing the "Avadex" into the soil.

The results this year indicate a reduction in the stand of both wheat and barley. A more cautious attitude must therefore be adopted with these crops until more investigational work is made. Effect of "Avadex" on varieties of wheat is essential before widespread use of the chemical can be recommended.

However, the trials this year have proved that wild oats can be controlled and that both species of wild oats are susceptible.

Specific Selectivity of "Avadex"

A detailed examination of the seedling showed how the wild oats were affected by the "Avadex".

When the coleoptile or the "shoot" of the wild oat was just below the surface of the soil or had just emerged, the tip was withered. The colour of the shoot was a grey or blue green, and some had bands of yellow, whilst odd ones had a complete loop.

In a further examination 7 or 8 days later, it was difficult to find these shoots. Only a thin strand of withered or dead tissue remained. Some of these shoots were slower in dying.

"Avadex" was still active 10½ weeks after spraying.

"Avadex" is a specific chemical designed to control wild oats, and the discoverers make no claim for the general control of broad-leaved weeds.

In our trials, "Avadex" had no effect on wild turnip weed and hare's ear mustard.

Recommendations

It must be clearly understood that any recommendation is based on only one year's work, and is tentative and subject to revision after more investigation in the future.

The uniform and good control of both species of wild oat warrants a recommendation for a larger commercial trial. This applies in particular to linseed, which showed no significant effect at all rates used.

Linseed.—A provisional recommendation for control of wild oats in linseed with "Avadex" as a pre-emergence spray is warranted.

The recommendation is:

(1) 1 lb. to the acre of active ingredient for good control, and 1½ lb. to the acre for more complete control.

(2) A "combining" of the area immediately after application of the spray.

(3) Seeding to follow as early as possible to give maximum protection to the crop.

(4) The recommendation applies to the variety, Walsh, only. The reaction of Marine and other varieties has yet to be determined.

(5) Growers are advised to spray on a portion of an area of linseed so that a comparison and an assessment of the sprayed area can be made with the unsprayed portion of the field.

Wheat and Barley.—A more cautious approach at this stage must be recommended for wheat and barley. This applies more specifically to wheat, where varietal differences could be a vital factor.

Recent American research with wheat indicates that deliberately delayed seeding following application and incorporation of "Avadex" may provide adequate crop safety.

Before trying "Avadex" on wheat, growers would be well advised therefore to await the result of investigations by the Department to determine more fully the techniques of application and the varietal resistance.

What Does the Future Hold?

There is much work to be done before we can get the best use from our latest chemical ally. It is proposed to test "Avadex" further next season in our free-working scrub soils.

I see no reason why "Avadex" cannot be mixed into the top soil at seeding without the costly cultivation before seeding.

This aspect will be tested in the coming season, because the implications have an important bearing on the economical use and practical application of "Avadex".

As the results for both wheat and barley show, accurate application is very important. Further, over-lapping of spray by the boom will result in a thinned stand of crop on the double sprayed area.

Now, if we can dispense with pre-working after spraying before seeding, a boom could be fitted behind the tractor to spray the area in front of the combine. This will reduce the danger of over-lapping and will overcome the objection of losing a planting rain.

This should be worthy of a thorough investigation.

The spectacular control we achieved with "Avadex" in three trials is most encouraging. "Avadex" could well be the break-through in our efforts to control the wild oat menace, which is responsible for heavy annual loss of yield in our winter crops.

"Avadex" may prove to be as important in wild oat control as 2,4-D has been in the last decade in our control of broad-leaved weeds.

It is well to remember that our first line of attack against weeds has always been good husbandry, and chemical weed control is a second line of defence. *You just can't farm out of a tin.*

Therefore, "Avadex," like 2,4-D, must be regarded as a useful aid to a good farmer in his efforts to control weeds.

We are indebted to Mr. C. Ziebell, of Mt. Tyson, for his whole-hearted co-operation in making these trials possible.

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Agricultural, Dairying, And Pastoral Statistics

Forms to be used for the annual collection of agricultural, dairying, and pastoral statistics have now been distributed to primary producers throughout the State.

Primary producers of all kinds (graziers, farmers, dairy farmers, orchardists, commercial flowergrowers, nurserymen, etc.) who occupy holdings of 1 acre or more, and *all* commercial poultryfarmers and commercial beekeepers are required to make returns.

Any such producer who has not received a form (A.P. 24) from the collector by the end of March should obtain one from the nearest police station and return it promptly, duly filled in, to the police collector.

Individual returns are treated as strictly confidential and are used only for the preparation of statistical aggregates.

—*Commonwealth Bureau of Census and Statistics.*

Tuberculosis-Free Cattle Herds

(As at 1st April, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons. "Inverary", Yandilla
Angel, W. D., "Summerhill", Murgon
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

The Cost Of A Baconer Pig

By J. CHRISTENSEN, Adviser, Pig Branch.

What does it cost to produce a baconer pig? This is one of many questions to which most people actively engaged in raising pigs are unable to produce any clear answer.

The success of any pig raising venture is judged on the financial returns obtained. It is therefore very necessary to keep accurate records of births, weights, feed consumption and so on. Unfortunately, few people keep any form of records to show the position of their pig raising activities, and of these only a small percentage are able to offer the cost figures concerned.

It must be appreciated that any figures compiled are applicable to a particular set of conditions. Variations in management and environment have an important bearing on the final results.

The figures appearing in this article are the result of work conducted at the Hermitage Regional Experiment Station, near Warwick, with Berkshire pigs. While they are accurate for the high standard of housing, management, and feeding conditions existing there, they must be considered only as a guide for the majority of farms.

It will be seen that various factors have an important bearing on the final results due to the sharing of costs. The number of pigs reared per litter has a bearing on the proportional share of the cost of keeping a sow, accommodating the pigs, and other incidental items. Thus a pig from a large litter bears a smaller proportional cost than one from a small litter.

Careful handling and proper management will result in better profits. Pigs which receive rough treatment and are chased around the pen unnecessarily cannot be expected to make gains comparable with the contented pig.

Correctly designed housing plays an important role, because pigs which are kept warm during the cold winter months and cool during the hot summer months will make better use of their feed.

Undoubtedly the most expensive item is feed, which accounts for approximately 80 per cent. of the total costs.

To determine the costs given here, one sow was chosen and a piglet from her litter was selected at random. Records of the food consumption of the sow from mating through pregnancy and until weaning of her litter are normally kept. Sows are fed in individual feeding stalls for accurate records, and to the be sure that each sow receives the correct ration.

Food Consumed By Sow

The sow's consumption of food was increased in progressive stages up to farrowing and the actual amounts of feed eaten are set out in Table 1. The protein meal consisted of a mixture of protein concentrates, while the grain ration comprised a mixture of wheat, barley and sorghum.

TABLE 1

Protein Mixture	Crushed Grain	Period When Consumed
Lb.	Lb.	
1·5	13·5	Weaning to Mating
147·5	655·5	Mating to Farrowing
164·5	387·0	Farrowing to Weaning at 8 weeks
Total 313·5	1,056·0	

Plate 1

Well Built Farrowing Pens. The litter was reared to weaning in one of these pens.

This sow reared a litter of nine pigs which were farrowed on November 12. As her cost of upkeep is shared by the litter, this baconer's share would amount to one-ninth of the sow's feed, and is approximately 35 lb. protein meal and 117 lb. grain.

Litter Management

From birth, the litter was encouraged to make use of the confined air space beneath a hover board fitted in one end of the creep section of the farrowing pen. Also provided in the creep area was a shallow dish containing fresh clean drinking water and another with a suitable creep mixture. Piglets drink water and nose in the creep meal when a few days of age. However, they only commence to eat appreciable quantities after the second week of life. At this stage the drinking water is fortified by the addition of sugar at the rate of 1 oz. to the gal. The piglets have free access to meal and water in specially designed self-feeders and waterers located in the creep area next to the hover board.

Creep Feed Consumed By Litter

Under the conditions provided, the piglets made rapid gains. The pig selected weighed 55 lb. at 8 weeks, though it was not the heaviest pig in the litter.

Table 2 shows the weekly totals of creep meal eaten by the litter of nine pigs. Consumption showed a marked increase after the third week, until by the final week the average daily consumption per piglet was approximately 2⅓ lb. Heavy weights at weaning are more in proportion to the amount of creep meal eaten than the sow's milk supply after the fourth week.

TABLE 2

Creep Meal Eaten Lb.	Period When Consumed
5·0	By end of 3rd week
19·0	During 4th week
31·5	During 5th week
65·5	During 6th week
97·0	During 7th week
146·0	During 8th week
364·0 lb.	= Total Consumption

Assuming that the piglet consumed an average quantity of creep, its share was approximately 40 lb.

Food Consumption From Weaning to Marketing

Following weaning the pigs creep mixture was changed over a period of 6 days to a growing ration, and during that time the pig concerned ate 12 lb. of meal.

Each pig was fed individually after the ninth week and each received a weighed amount of meal fed twice daily.

The feed eaten by this pig after the ninth week is shown in Table 3.

It will be observed that this pig's feed was retricted to a maximum daily ration of 5 lb. consisting of a protein and grain mixture. The percentage of protein in the ration was reduced as the pig increased in weight. During the last 3 weeks, the weight of protein supplement in the ration was less, though the total meal fed was the same as in the previous fortnight.

TABLE 3

Protein Mixture	Crushed Grain	Period When Consumed
Lb.	Lb.	
4·5	13·0	During 10th week
5·75	17·0	During 11th week
7·00	21·0	During 12th week
6·25	25·25	During 13th week
6·75	26·5	During 14th week
7·0	28·0	During 15th week
7·0	28·0	During 16th week
5·25	29·75	During 17th week
5·25	29·75	During 18th week
5·25	29·75	During 19th week
Total=60·00	248·0	

Following weaning, this pig along with others was penned in a grazing paddock where a fair growth of native pasture was available. During this period the food conversion ratio was about 2·8 : 1.

Liveweight of pig at marketing (19 weeks)	172 lb.
Actual dressed weight at factory	126 lb.
Grading	Prime
Marketed 23-3-60.	

Cost of Foodstuffs

Costs for each foodstuff were calculated on the prices ruling at the time in the Warwick area and are set out in Tables 4 and 5.

TABLE 4

40 Lb. Creep Mixture	Cost per Lb.	Total £	s.	d.
12·0 lb. buttermilk powder ..	@ 9d.		9	0
4·0 lb. meatmeal	@ 5d.		1	8
4·0 lb. livermeal	@ 7d.		2	4
4·0 lb. pollard	@ 2½d.			10
8·8 lb. crushed grain	@ 1½d.		1	1
5·2 lb. sugar	@ 0½d.		4	6½
2·0 lb. whey powder	@ 6½d.		1	1
	Total ..	£1	0	6½

The amount of feed required and its cost for each period of growth is set out in Table 5.

TABLE 5

			£	s.	d.
One-ninth share of sow's feed =	35 lb. protein mix	@ 6d.	1	12	2
	117 lb. grain ..	@ 1½d.			
One-ninth share of creep meal = 40 lb.			1	0	6
Feed consumed during 9th week = 12 lb.		@ 4d.		4	0
Feed consumed during growing period to marketing—					
	60 lb. protein mix	@ 6d.	3	1	0
	248 lb. grain	@ 1½d.			
Total feed ..	512 lb.		£5	17	8

The factory first advance payment for the pig at 2s. a lb. amounted to £12 12s.

A small allowance for the share of the boar's upkeep should be included (approximately 1s.) Feed costs will fluctuate according to the season; likewise returns for pigs do vary.

However, where reliable records are kept, the actual feed costs for any litter of pigs can be calculated on lines similar to the method outlined.

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Future of Wool

"In the light of what has already happened in U.S.A., where a substantial and increasing share of the wool market has been lost to synthetics, and the indications that the same situation is developing in other countries, it is evident that only the strongest possible action will ensure the survival of the Australian wool industry, let alone its future prosperity."

—*Extract from a market research report.*

White French Millet For Chickens

By H. W. BURTON, Poultry Adviser,

And F. N. J. MILNE, Senior Poultry Husbandry Officer.

Trials have shown that white French millet can be used extensively in all-mash chicken starter rations as a meal or as a whole grain. An average of 10·5 per cent. protein should be used for it when formulating mashes based on calculated values.

About three years ago, small quantities of white French millet were offered to poultry farmers as a grain feed. The price was attractive, but we were unable to give the "green light" on its use as there was little information on it as a whole grain feed or as an important mash constituent. Scientific literature on its use was scanty, and opinions varied as to its relative feeding value as compared with other grains such as wheat, maize or sorghum. Farmers who used white French millet commented favourably on it. Thus, there was urgent need for the Department to gain information by setting up a series of feeding trials, with chickens as the "test" animals, at the Poultry Section of the Rocklea Animal Husbandry Research Farm. It was thought that if the grain proved suitable for chickens, then it should be useful for layers.

The trials were designed firstly to test the effect of crushed millet as the sole grain in the ration or in combination with wheatmeal, on growth rate and feed conversion. Secondly the trials were designed to see whether millet could be included in the rations in its whole state, either alone or with wheatmeal, as it is a small, hard, but attractive grain. Because of its smallness and hardness, the possibility that this grain would pass through the bird without being digested needed investigation.

The Experiments

The experimental rations were made as simple as possible and all contained the same amounts of bran, pollard, meatmeal, livermeal, salt, vitamins (A, D_3, B_2) and minerals. Only the quantities of wheatmeal and crushed or whole millet were varied. Table I shows the composition of these chick starter all mash rations.

In the first trial, using Australorp cockerels obtained from a commercial hatchery as day-old chickens, calculated protein values for wheat and white French millet obtained from published tables of food values were used. However, it became rather obvious that by 7 weeks of age, the average weight of chickens fed mashes containing wheatmeal only or a combination of wheatmeal and ground white French millet showed a slight upward trend as the wheatmeal component increased although feed conversion as indicated by the "Feed to Gain" ratio (average feed consumed per chicken/average gain in weight per bird) favoured those groups fed rations containing higher levels of white French millet. The use of whole white French millet did not appear to exert any serious adverse effect on weight gain or food conversion.

The results were sufficiently variable to call for stock food analyses of the wheat and white French millet used in this trial. The results showed that the actual analytical values were far removed from the "text book" values; the wheat used in this trial being 14·9 per cent. protein, whilst the white French millet was only 9·4 per cent. This resulted in those rations containing higher levels of wheat meal in combination with white French millet being higher in total crude

TABLE 1

EXPERIMENTAL RATIONS

Ingredient	Ration 1	Ration 2	Ration 3	Ration 4	Ration 5	Ration 6	Ration 7	Ration 8
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Millet (Ground)	60	40	20	..	..	..	..	..
Millet (Whole)	..	..	..	..	60	40	20	..
Wheatmeal	..	20	40	60	..	20	40	60
Pollard	21	21	21	21	21	21	21	21
Meat and Bone Meal (55% protein)	12	12	12	12	12	12	12	12
Livermeal	4½	4½	4½	4½	4½	4½	4½	4½
Salt	½	½	½	½	½	½	½	½
Vitamins A and D_3 ..	+	+	+	+	+	+	+	+
Manganese Sulphate ..	+	+	+	+	+	+	+	+
Riboflavin (B_2)	+	+	+	+	+	+	+	+
Total	100	100	100	100	100	100	100	100

protein (T.C.P.) than rations containing less wheatmeal and more white French millet—for example, T.C.P. for rations 1 and 5 (60 per cent. millet) was 19·2 per cent. while T.C.P. for rations 4 and 8 (60 per cent. wheatmeal) was 21·7 per cent. This does illustrate the need for constant chemical control and testing of ingredients in mash formulation and mixing, particularly, when applied to the production of table chickens where even small differences in protein levels influence growth rates significantly.

In planning the second and third trials, it was essential to obtain supplies of wheat and millet which were of very similar protein content so as to mix rations with only a narrow range in protein level. Suitable supplies were obtained and on analysis the eight experimental rations showed a protein range from only 19·4 per cent. to 20·0 per cent. As in the first trial, the standard brooding and rearing procedures were to brood for the first 4 weeks in a four deck electrically heated battery brooder, after which the chickens were transferred to wire floored weaning cages and remained there until 7 weeks of age. All chickens were debeaked at 7 days. Individual weighings of all chickens were carried out weekly and food consumption was recorded on this basis. Australorps were used in the second trial and crossbreds (White Leghorns x Australorps) in the third trial.

Weight Gains

The average weight gains were very similar for all rations irrespective of white French millet content. However, there was a tendency for the average weight of chickens fed rations containing "whole" white French millet to be slightly less than those weights obtained on similar rations with "ground" white French millet.

Feed Consumption and Palatability

Had the chickens been unable to digest the grain, then the feed consumption would have been increased. An examination of the droppings would readily have shown the presence of undigested grain. On examination, only a few millet grains were noticed in the droppings for the first 3 days of age, thereafter practically no grains were sighted.

Food consumption was greatest in rations 4 to 8 (60 per cent. wheatmeal). The 60 per cent. millet ration (1 and 5) were very much the same, although the food consumption of ration 5 (60 per cent. whole millet) was slightly less. This gives ample proof of the digestability of the millet grain.

"Food to Gain" Ratio

The "food to gain" ratio is obtained by dividing the average food consumed per bird by the average gain in weight and is a measure of food efficiency. It is a very useful measurement to use in assessing the overall nutritive and economic values of a mash.

In all three trials, the 60 per cent. crushed millet ration was the most efficient, while rations containing 60 per cent. wheatmeal were the least efficient. This undoubtedly shows that crushed millet is equal to and slightly superior to wheat when included in chicken starter rations. The second most efficient ration over the three trials was the 60 per cent. whole millet, again proving the ability of young chickens to handle this grain.

Does White French Millet Cause Losses?

All deaths that occurred during the term of the experiments, that is, from day-old to 7 weeks, were recorded, and the chickens sent to the Animal Research Institute, Yeerongpilly, for autopsy. In all, 34 chickens out of 680 died, giving a death rate of 5 per cent., which is not excessive by normal practice. Losses occurred in all groups except the group on 60 per cent. whole millet. This suggests that millet has no harmful effect on chickens.

The Economics

White French millet can replace wheat in an all mash chick starter ration. Let's consider its economic implications.

At the commencement of the experiment wheatmeal was obtained landed on the farm for £32 8s. a ton, crushed millet was obtained at £21 a ton and whole millet at £18 a ton landed on the farm.

The relative costs of the grain components per ton of mash in the rations used in these trials was as follows:

		£	*s.*	*d.*
Ration 1	60% crushed millet	12	12	0
Ration 2	40% crushed millet + 20% wheatmeal	14	17	7
Ration 3	20% crushed millet + 40% wheatmeal	17	3	2
Ration 4	60% wheatmeal	19	8	9½
Ration 5	60% whole millet	10	16	0
Ration 6	40% whole millet + 20% wheatmeal	13	13	7
Ration 7	20% whole millet + 40% wheatmeal	16	11	2
Ration 8	60% wheatmeal	19	8	9

Ration 5 (60 per cent. whole millet) is cheaper by far, as there was no added cost for crushing (£3 a ton). Ration 1 (60 per cent. crushed millet) was slightly better in feed conversion, but this would be offset by the reduced price of ration 5. Rations 4 and 8 (60 per cent. wheatmeal) are by far the most expensive. It would appear that little could be gained by using a combination of the two grains, however, if this was desired, ration 6 (40 per cent. whole millet + 20 per cent. wheatmeal) would be the logical choice.

Summing up the Results

The trials have shown that under the conditions of the experiments:

1. White French millet can be used extensively in all-mash chicken starter rations as a "meal" or as a whole grain.
2. It has no depressing effect on growth and is not apparently toxic to poultry.
3. It is interchangeable with other common grains in an all-mash chicken starter ration.
4. Because of the range in protein value in various samples of white French millet it is suggested that an average figure of 10·5 per cent. protein be used in formulating mashes based on calculated values.

* * *

New Attack On Nut Grass In The Burdekin

By G. VERHOEVEN, Experimentalist; and
W. A. R. COWDRY, Senior Experimentalist.

Nut grass (*Cyperus rotundus*) is one of the most troublesome perennial weeds of cultivated land in the tropics and subtropics. Trials at the Ayr Regional Experiment Station have thrown new light on methods of control.

Techniques for controlling this pest have been under investigation for some time. But because of its efficient system of vegetative propagation, only fumigation with methyl bromide has been effective. However, because of its high cost, the use of this chemical is limited to small areas.

Methods of control, for use when this pest covers considerable areas, have been tested on the Ayr Regional Experiment Station during the past two years.

In countries with an arid climate, dry cultivation as a means of control has been practised for many years. The method is based upon the fact that high temperatures together with low levels of soil moisture will rapidly reduce the viability of nut grass tubers, depending on the length of exposure and the size of the tubers. A combination of this method and hormone spraying was used in the trials at the Ayr Station.

Suitable weather for this method of control exists in the Burdekin district from May until December. Temperatures are usually sufficiently high to raise the temperature of bare soil above 100 deg. in the top 3 in. for some hours. It has been shown that an average daily maximum of 100 deg. or over is sufficient to kill tubers if these conditions are maintained for 2 to 3 weeks. In this district, rains are unlikely to occur during this period, so that the soil remains dry and its temperature fairly high.

Hot Soil

Temperatures taken during the course of this experiment revealed that in the period November to early December, the maximum temperatures ranged from 118 deg. at 1 in. below the surface to 97 deg. at 4 in. below the surface in a rather cloddy clay loam. Readings as high as 127 deg. were obtained in more sandy soils.

Moreover, it was found from an analysis of the data obtained from this experiment that 48 per cent. of the tubers are found in the top 3 in. of soil, 27 per cent. in the 3 to 6 in. level, 17 per cent. in the 6 to 9 in. level, and only 8 per cent. at the 9 to 12 in. layer. Very few tubers were found below this depth, but odd nuts have been located below 30 in.

The dry cultivation operations, alone not sufficient to achieve control under Burdekin conditions, open the way for effective 2,4-D spraying. Use is made of the fact that the topmost nut in a chain of tubers will always shoot first. Therefore, if the chains are broken up, more nuts will shoot and the subsequent hormone spraying will be all the more effective.

Plate 1

A General View of the Nut Grass Control Experiment. The control plot is in the foreground.

Design of Experiment

The experiment was commenced in 1959 and included the following treatments:

A. Ploughing to a depth of 10 in., followed by regular discing to accelerate the reduction of soil moisture. Application of 2, 4-D (amine salt) at the rate of 4 lb. acid equivalent an acre, before the commencement of the wet season. Regular sprayings with the same hormone at 3 lb. an acre, plus 1 gal. white oil in 50 gal. of water.

B. Disc harrowing to 3 or 4 in. followed by progressively deeper ploughings at intervals. Hormone sprayings similar to treatment A.

C. No dry cultivation but hormone sprayings as in treatment A.

D. Control (check plot). No cultivation and no spraying.

With nut grass, the number of shoots above ground level does not give an accurate indication of the degree of infestation. Therefore, a count was made of the actual number of live tubers. The numbers in each 3 in. layer in the top foot of soil were recorded separately.

Samples were taken from 12 one-foot-square sites in each treatment, the soil from each 3 in. layer being sieved carefully to obtain the tubers. After dusting with a fungicide to prevent mould growth, their viability was determined by growing in trays of wet sand.

The whole area had been ploughed in April and disced early in June, before the start of the trial in July.

Plate 2

A Close-Up of the Nut Grass Control Trial Shows the Shooting of the Nuts after the First of the Wet Season's rains. The striking decline in nut grass infestation from dry cultivation (treatment B) is contrasted with the unchecked growth in the control plot.

TABLE 1
Numbers of Live Nuts at Each Sampling

Sampling Dares	A Treatment		B Treatment		C Treatment		D Treatment	
	0–3 in.	0–12 in.	0–3 in.	0–12 in.	0–3 in.	0–12 in.	0–3 in.	0–12 in.
16–7–59	192	428	362	945	329	854	443	1,156
18–8–59	99	382	113	539	Not sampled		389	943
28–9–59	9	119	32	326	Not sampled		311	762
9–11–59	1	121	4	124	Not sampled		317	840
18–12–59	10	92	7	112	Not sampled		440	881
23–3–60	Not sampled		1	14	76	266	918	1,470

Ploughing was carried out as planned for treatment A. But without depth control it was impossible to carry out the B schedule accurately, so that in the later stages this treatment became similar to A.

Results Obtained

At the first sampling it was found that the April and June dry cultivations had already killed a number of nuts, indicating the advantage of an early commencement of cultivation.

The number of live nuts obtained at each of the sampling dates is summarized in Table 1, and is portrayed graphically in Plate 3. The data for each 3 in. level is shown in Plate 4.

It was shown that a marked reduction in the numbers of live nuts occurred in both treatments A and B throughout the period of dry cultivation. Further, the gradual reduction in the number of nuts in the top layers of soil during the dry cultivation is clearly seen in Plate 4. The comparison between treatment B and the "control" is most marked.

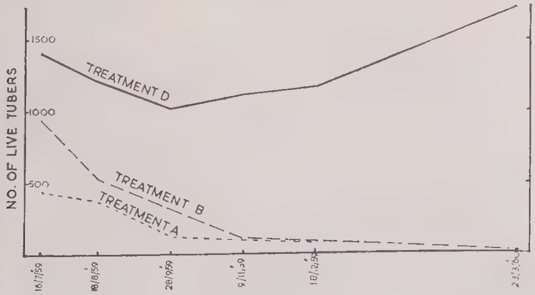

Plate 3

A slight reduction was also observed in the control plots until November, due to natural death under the dry conditions prevailing. However, it was noted that while the numbers afterwards rose in the control areas, they continued to decline in the plots that had been cultivated.

The efficiency of the applications of 2, 4-D from January onwards is manifested by the lower number of live nuts obtained in March from plots treated with this weedicide, compared with the greatly increased numbers of tubers found in the check (untreated) plots at that time. The data from treatment C support this. However, the relatively large number of nuts remaining in the plots of this treatment detracts from its final value.

Only a few shoots emerged after the last spraying—an average of 1·4 to the sq. yd.—so that one, or possibly two more spot sprayings with 2,4-D would probably have completely controlled the pest in this heavily infested area.

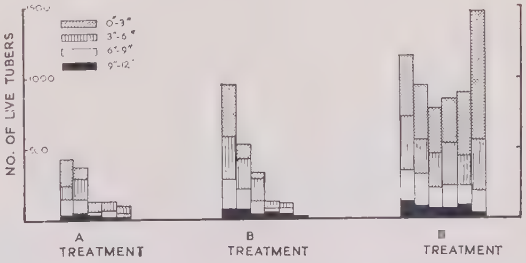

Plate 4

Sub-treatments

Three sub-treatments were superimposed over the trial area during December-January. These, together with their effect, were as follows:

(*a*) A heavy application of 2,4-D (15 lb. acid equivalent to the acre) did no more than kill the above-ground shoots.

(*b*) Rhodes grass was planted, but its slow growth did not hinder the growth of nut grass.

(*c*) A cowpea cover crop was planted at 30 lb. an acre. But the initial growth was slow, and no reduction of the nut grass was achieved.

Cost

For better evaluation of the results, a calculation was made of the costs involved. This was based on six ploughings, six cultivations and six sprayings. At present market prices, these costs would amount to approximately £17 an acre, exclusive of labour. This is not considered to be excessive when it is assumed that a nut grass infestation can be reduced to such a level that by careful management, normal cropping should again be possible for a number of years.

Recommendation

The undermentioned schedule is proposed in order to obtain control of nut grass in the Burdekin district:

1. Allow the summer growth of grass to remain only long enough to permit an efficient ploughing to 10 in. deep or more.
2. After one month, invert this ploughed layer and repeat at intervals of 4 to 6 weeks at various depths. Break up large clods by discing. If rain should interfere, disc the area and lengthen the period between ploughings. Use a spring-tine cultivator, if available.
3. Make the final cultivation as near to the commencement of the wet season as possible, to leave a smooth tilth for the application of the spray.
4. Apply 2,4-D (4 lb. in 50 gal. water to the acre) before the onset of the wet season, to act as a pre-emergent weedicide. Pay particular attention to ground coverage. Include white oil as a wetting agent.
5. At intervals of 2 to 3 weeks apply 2,4-D (3 lb. an acre in 50 gal. of water). Add white oil.
6. If necessary, after 3 or 4 sprayings, disc to restrict grass growth and to facilitate sprouting of the remaining nuts.
7. Continue these sprayings until the end of the wet season.
8. Make further spot sprayings as necessary for more complete control and possible eradication.

Hormone sprays have strong residual effects. For this reason, it will be best to allow a short fallow period before planting if either maize or sorghum is planned.

If the use of 2,4-D is undesirable owing to proximity to susceptible crops, a dense stand of cowpeas, sweet sorghum or a similar smother crop should be established during the wet season to prevent re-establishment or re-infestation. It is stressed that a quick coverage of cowpea is absolutely essential, otherwise the effect of the previous dry cultivation will be lost.

Alternatively, on the lighter types of soil, further control can be obtained by tine or disc cultivation at intervals of not more than 3 weeks.

If 2,4-D sprayings are omitted, more than one season will be necessary before satisfactory control is obtained. During that period a careful cropping programme designed to prevent re-infestation, and dry cultivation during the fallow period, should be practised.

Acknowledgement

Acknowledgement is made to Mr. F. Meijer, Assistant Experimentalist, who carried out most of the sampling, and who was responsible for the viability tests on the tubers.

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Talks At Brian Pastures

Main points in the talks at the afternoon's session at the Brian Pastures Field Day on April 11 were as follows (morning's session on page 226):

Legumes on Granitic Soils.—C.S.I.R.O. pasture investigations at Brian Pastures are solely concerned with the granitic soils of the property. The broad objective has been to examine species and soil nutrient status with a view to the development of sown pastures to replace the existing low quality native pasture. Experiments have been conducted in the field, and in the glasshouse at Brisbane and Lawes.

The soil on the experimental site is a deep coarse sand which dries out quickly on the surface. It is somewhat deficient in sulphur and phosphorus, and the nitrogen content is low. In addition it is heavily infested with nematodes, and altogether it has presented many difficulties in pasture development.

Species selection has been concentrated on legumes. Until recently the only legumes that had grown successfully were several species of the genus *Stylosanthes*, species closely allied to Townsville lucerne. Some of these have persisted for 6 years and have been more productive than Townsville lucerne over this period. These species show considerable promise, but expansion of experimental work has been held up by problems of seed production. More recently two new legumes *Phaseolus atropurpureus* (Atro) from Mexico, and *Lotononis bainesii* from South Africa have shown particular promise in initial trials and these are now being examined more closely. Lucerne, *Glycine javanica*, and phasey bean, which all grow well on the basaltic soils of the property, are unproductive on the granite.

Timber Regrowth Control.—Numerous trials have been conducted on Brian Pastures to find the best method of killing unwanted timber and preventing suckering after treatment. Almost all trials have been conducted on bloodwood.

The best treatment method was a complete frill at or very near ground level. The height of this frill is critical.

The most effective herbicide so far tested is 2,4,5-T butyl ester carried in diesel distillate. Mixtures of distillate and sump oil are promising as carriers and would be cheaper. Water was ineffective. The recommended concentration is 2 per cent. and enough liquid to wet the cut surface is sufficient. The use of a vivid colouring dye to mark the treated trees is recommended.

A time of application trial is continuing but present trends indicate that treatments from January to at least August give satisfactory results.

Time of Calving and Early Weaning.—In the main breeding herd at Brian Pastures, mating is restricted to a 2-month period commencing in early January each year, to give a calving period from mid-October to mid-December. It has been the practice to wean calves in August.

These periods for mating and weaning are similar to those adopted on a large proportion of beef properties in the Burnett and adjoining districts.

There have, to date, been no data from controlled experiments to indicate whether these are the most suitable periods for mating and weaning. Experiments have been initiated at Brian Pastures to provide evidence on these points.

A time of calving experiment is in progress in which three groups each comprising 22 cows are mated at different periods, namely:

Group 1, October 8 to December 7; group 2, January 8 to March 9; group 3, April 8 to June 7.

The trial commenced in 1958-59 and will continue for at least five mating seasons.

Data will be presented on performance to date of calves of the first two calvings in this trial.

Comparisons have been made in several years of the growth rate of groups of calves weaned in May with that of calves weaned at the normal period in August.

While the early weaned calves show lower growth rate subsequent to weaning in May, this difference is usually eliminated by greater growth rate in the period following weaning of the other calves in August.

Lucerne and Native Pasture.—Two approaches to the use of lucerne and native pasture were discussed.

Recorded Cows Kept Production Up

By S. E. PEGG, Chief Adviser, Herd Recording.

Despite the low rainfall experienced during 1960, the average yield per cow of animals which completed a recorded lactation under the Group Herd Recording Scheme during 1959-60 remained approximately the same as for the more favourable 1958-59 testing period.

A total of 47,607 cows from 1,287 herds were tested, and they recorded an average production of 4,038 lb. milk and 169 lb. fat. This compares very favourably with 4,022 lb. milk and 170 lb. fat for the previous year.

The 1959-60 group herd recording year ended on September 30, 1960. During this period good rains were experienced towards the end of 1959. However, in January, 1960, the State had one of the longest and severest heat waves ever experienced. The normal monsoonal rains of February and March did not eventuate and throughout the rest of the year falls of rain were light. Most districts received less than half their average rainfall and towards the end of the period drought conditions prevailed.

Under such circumstances the average production of 169 lb. fat is very satisfactory.

It appears that the yield of cows which calved before the end of 1959 was not affected greatly by the later dry season. It is expected that the effects of the drought will be reflected in the results of the 1960-61 recording year.

One of the contributing factors towards the relatively high annual average yield could have been the very favourable price of beef which encouraged the culling of lower milk producing cows. In these circumstances remaining cows obtained increased benefit from the limited feed available.

The average yield of 169 lb. fat is the second highest obtained since group herd recording was instituted in 1948.

The average production of cows in age groups is shown in Table 1.

TABLE 1

Age Group	Cows	Average Production per Lactation		
		Milk lb.	Test %	B. Fat lb.
2-year-old	7,647	3,453	4·3	147
3-year-old	5,971	3,673	4·2	156
4-year-old	4,568	4,069	4·2	173
Mature	21,298	4,371	4·1	181
Unknown age ..	8,023	3,966	4·1	164
Total	47,607	4,038	4·2	169

Cows of Unknown Age

A total of 8,023 cows, representing 16·8 per cent. of the total are listed as being of unknown age. Although this is below the 20·7 per cent. of last year it is still far from satisfactory. Members of herd recording groups are issued with shed sheets and individual shed books and these should enable accurate records to be maintained.

It is known some recorders assist their members in keeping records and in these groups there are few cows of unknown age. The large number of cows of unknown age indicates that the increased value which can be obtained from records if producers and recorders combine to keep Shed Sheets and individual Shed Books up-to-date, is not being obtained on many properties.

TABLE 2

Group Herd Recording for 1959–60

District/Group	Herds	Cows	Average Length Lactation Days	Average Milk lb.	Average Test Per cent.	Average Butter Fat lb. 1959/60	Average Butter Fat lb. 1958/59
Atherton Tableland	*39*	*1,260*	*250*	*4,193*	*4·1*	*170·0*	*160·6*
Malanda No. 1	7	300	257	5,032	4·2	208·9	190·2
Malanda No. 2	11	233	249	4,074	3·7	152·7	141·9
Malanda No. 3	7	229	250	4,237	4·0	169·6	157·5
Millaa Millaa	14	498	248	3,723	4·2	157·4	156·1
Mackay	*13*	*459*	*236*	*3,123*	*4·1*	*129·3*	*133·2*
Port Curtis	*44*	*1,407*	*244*	*3,133*	*4·4*	*139·1*	*131·0*
Mount Larcom	13	383	237	2,708	4·4	120·5	117·7
Rockhampton	16	648	246	3,314	4·4	147·3	143·9
Bundaberg No. 1	10	172	244	3,105	4·4	136·9	147·8
Bundaberg No. 2	5	204	254	3,383	4·4	150·0	127·6
Dawson–Callide	*47*	*2,170*	*233*	*3,396*	*4·3*	*146·4*	*152·3*
Biloela No. 1	17	909	243	3,603	4·6	165·5	166·6
Biloela No. 2	17	876	224	3,353	4·1	137·7	153·6
Wowan	13	385	232	3,007	4·0	121·2	130·4
Upper Burnett	*35*	*1,817*	*240*	*3,678*	*4·3*	*159·9*	*176·6*
Monto No. 1	16	817	233	3,438	4·3	146·7	163·5
Monto No. 2	19	1,000	246	3,874	4·4	170·7	188·7
Central Burnett	*38*	*1,636*	*245*	*3,828*	*4·2*	*159·9*	*169·5*
Biggenden	20	888	250	3,777	4·2	157·2	174·4
Mundubbera	18	748	239	3,888	4·2	163·1	164·5
South Burnett	*222*	*8,348*	*239*	*4,069*	*4·1*	*166·0*	*170·0*
Durong–Wondai	18	893	252	4,666	4·0	188·7	176·3
Kilkivan	21	688	240	3,311	4·4	145·9	146·5
Kingaroy	31	971	231	4,589	3·8	175·2	195·7
Kumbia–Ironpot	13	552	236	4,504	3·7	167·0	165·9
Murgon	19	846	236	3,978	4·0	160·5	178·6
Nanango No. 1	20	804	238	3,756	4·2	157·0	163·6
Nanango No. 2	21	941	234	3,939	4·0	157·2	179·4
Nanango No. 3	19	704	240	4,180	4·0	166·3	178·0
Proston	21	564	227	3,604	4·4	159·3	154·0
Tansey	15	614	245	3,411	4·5	154·5	150·0
Wooroolin–Tingoora	24	771	245	4,433	4·2	185·4	168·9
South East Queensland	*550*	*21,012*	*247*	*3,905*	*4·2*	*165·7*	*164·4*
Beaudesert No. 1	17	874	246	4,298	3·6	152·6	170·6
Beaudesert No. 2	8	318	250	4,425	4·0	178·2	156·4
Beechmont–Currumbin	22	870	246	3,922	4·3	168·1	147·1
Beenleigh	18	965	241	3,832	4·0	154·5	162·7
Boonah	29	1,022	242	4,222	4·4	183·9	190·7
Brisbane No. 1	27	630	257	4,764	3·8	179·3	189·4
Brisbane No. 2	19	918	257	4,602	3·8	173·1	150·7
Cedar Pocket	17	670	253	3,935	4·7	183·6	156·2
Cooroy	17	745	248	3,638	4·6	167·1	159·5
Esk No. 1	16	795	243	3,881	4·0	153·5	163·0
Esk No. 3	20	687	251	4,073	4·1	167·5	163·7
Gatton	19	631	234	3,767	3·9	147·6	145·8
Gympie No. 1	19	942	230	3,018	4·7	142·8	146·8
Gympie No. 2	15	779	239	3,240	4·5	146·1	150·4
Ipswich No. 1	16	344	251	3,667	4·1	151·2	169·6
Ipswich No. 2	21	618	252	4,211	4·1	171·6	183·6
Ipswich No. 3	20	508	245	4,624	3·8	176·7	176·8
Kenilworth	19	907	262	4,317	4·6	198·9	167·9

TABLE 2—*continued*

GROUP HERD RECORDING FOR 1959–60—*continued*

District/Group	Herds	Cows	Average Length Lactation Days	Average Milk lb.	Average Test Per cent.	Average Butter Fat lb. 1959/60	Average Butter Fat lb. 1958/59
Kilcoy	34	1,621	246	3,318	4·4	144·4	148·4
Laidley	19	475	224	3,380	4·0	136·3	138·4
Lowood	18	522	246	4,118	4·4	179·2	178·1
Maleny No. 1	22	668	255	3,692	4·8	175·9	164·3
Maleny No. 2	15	504	260	3,768	4·8	179·9	170·7
Maleny No. 3	9	485	264	4,678	4·4	205·4	219·3
Maryborough	18	531	253	3,577	4·1	148·3	147·0
Merrimac–Mudgeeraba	17	773	246	4,534	4·0	180·5	177·2
Nambour	24	781	244	3,308	4·5	148·6	148·1
Pomona	18	680	252	4,181	4·6	192·7	174·8
Wolvi	18	749	233	3,385	4·6	157·2	160·1
Eastern Downs	*208*	*6,050*	*247*	*5,050*	*4·1*	*207·0*	*206·1*
Allora No. 1	15	438	248	5,093	3·9	201·1	191·7
Allora No. 2	18	424	254	5,722	4·0	230·1	227·8
Crow's Nest	20	775	242	3,869	4·4	168·4	176·0
Goombungee	20	610	235	4,122	4·3	178·4	191·8
Oakey	22	858	240	4,763	4·1	197·4	205·1
Pittsworth	22	648	250	5,642	3·9	222·5	220·6
Pittsworth No. 2	14	338	261	5,369	4·3	232·4	222·9
Toowoomba No. 1	20	655	253	5,713	4·0	230·4	224·2
Toowoomba No. 2	28	575	250	5,233	3·9	202·5	191·0
Warwick No. 1	17	460	249	5,488	4·0	222·1	218·7
Warwick No. 2	12	269	251	5,755	4·2	244·4	233·3
Western Downs	*91*	*3,448*	*231*	*4,132*	*4.0*	*166·1*	*179·8*
Chinchilla	17	638	229	4,000	4·0	161·8	192·9
Chinchilla–Wandoan	17	429	245	4,740	4·3	204·4	194·4
Dalby No. 1	20	662	222	4,127	3·9	161·5	184·3
Dalby No. 2	22	808	242	4,368	4·0	172·8	177·7
Jandowae	15	911	223	3,734	4·0	148·6	164·2
Queensland Figures	*1,287*	*47,607*	*243*	*4,038*	*4·2*	*168·8*	*170·0*

Length of Lactation

The average length of lactation was 243 days, the same as for the previous year. This is a significant increase on the average 220 days lactation period when group recording was commenced in 1948-49. Surveys have shown that there is a strong positive correlation between the length of lactation and total production. If the average length of time for which a cow milks can be raised to 9 months, then the average yield of the State's herds will show a corresponding increase. This will assist to a large degree in obtaining the maximum benefit from the milk producing ability of the cow.

Butterfat Ranges of Cows and Herds

A total of 6,814 cows or 14·3 per cent. of all recorded animals yielded less than 100 lb. fat. This is too high a percentage as it means that one cow in every seven gave less than 100 lb. fat. Such cows must be uneconomical and unless there is a very strong reason for their low yields they should be eliminated from the dairy herds. It is considered that under Queensland conditions an average yield of 200 lb. fat is possible. To achieve this, a further improvement in the quantity and quality of feed available to dairy herds will be necessary but it is hoped that the average yield of recorded cows will reach this standard within the next decade.

Some 24·6 per cent. of the herds averaged over 200 lb. compared with 23 per cent. in 1958-59. There are still 40 per cent. of the herds averaging under 150 lb. fat. The herds which averaged less than 100 lb. fat decreased from 7·7 per cent. last year to 7·2 per cent.

Production in Each Group

The average production for each herd recording group is shown in Table 2.

The groups are listed according to district and the average yield of each district is shown also.

Highest Producing Herds

The highest producing herds are listed in Table 3 in sections according to the number of cows which completed recorded lactations.

The highest average yield was obtained by Mr. L. G. Weier, Allora. His 12 grade cows averaged 9,462 lb. milk and 365 lb. fat. In addition to these grade cows he had 11 registered animals which completed their recorded lactations in the 1959-60 Pure Bred Recording year. Their average production was 9,738 lb. milk and 366 lb. fat.

Much of the success of these herds is due to the high standard of management reached on the farms.

The old adage that "half the breeding is feeding" has been proved wrong by recent research in New Zealand. By placing sets of identical twins in low- and high-producing commercial herds they were able to show that between 80 to 90 per cent. of the differences in production are due to farm and herd management,

An excellent example of the value of feeding is shown by the results of the herd of Macfarlane Bros., Ipswich No. 3 Herd Recording group. This herd of 70 cows averaged 8,655 lb. milk and 325 lb. fat to become the second highest herd in the 51-100 cow section.

This herd was first submitted for recording in the 1956-57 year and the owners then embarked on a fodder conservation programme which has raised the yield considerably.

By relating herd and farm managements practices to the production results of individual cows, it has been possible to increase average butterfat production per cow from 103 lb. for the initial 33 cows which completed a recorded lactation to 325 lb. per cow in four seasons. The average length of lactation has increased correspondingly from 171 days to 293 days in the same period.

TABLE 3

HIGHEST HERDS 1959–60

Highest Herd	Group	Breed	Cows	Milk	Test	Fat	Days
11 to 20 Cows—							
L. G. Weier	Allora No. 1 ..	AIS	12	9,642	3·8	365	282
N. Sippel	Lowood	J.	20	6,721	4·7	314	274
A. and D. Krautz ..	Toowoomba No. 2..	AIS	13	7,803	3·9	301	277
21 to 50 Cows—							
J. H. Fletcher	Warwick No. 1 ..	AIS	42	8,654	3·9	341	291
G. I. Holmes	Pittsworth No. 1 ..	AIS	34	8,585	3·8	322	281
L. V. and L. M. Armbruster	Warwick No. 1 ..	AIS	31	8,516	3·8	320	271
51 to 100 Cows—							
D. J. McInnes	Durong–Wondai ..	AIS	68	8,427	3·9	329	286
Macfarlane Bros. ..	Ipswich No. 3 ..	AIS	70	8,655	3·7	325	293
A. J. Pearson	Kenilworth	J.	65	6,096	4·8	294	291
101 Cows and Over—							
P. A. Black	Wooroolin–Tingoora	Mixed	114	5,066	3·9	196	257
A. R. Reidy	Durong–Wondai ..	AIS	118	5,085	3·8	192	242
R. L. Harrison ..	Beaudesert No. 1 ..	AIS	181	5,134	3·4	175	258

* * *

Grape Vine Diseases

By **K. N. Shea, Pathologist.**

Successful grape growing in Queensland requires routine control of three major diseases and occasional control of some minor ones.

The grape vine is attacked by many plant diseases, of which the most important in this State are downy mildew, powdery mildew and anthracnose. It is usually necessary to control these every year. The vine is also subject to several other troubles which, while not normally serious, can occasionally become so. Fortunately, most of these can be controlled adequately by timely action if they are recognised and their methods of spread and control are understood.

Losses from disease vary widely from year to year and from district to district. The most important factor affecting this variation is usually the weather during the critical periods for infection. Weather conditions sometimes suppress the development and spread of the organisms causing the diseases; unfortunately they often favour them.

On the coast the humid weather so favours downy mildew that commercial plantings will be completely defoliated unless a full and vigorous spray programme is adopted. Even then, some losses must be expected in some years.

In drier areas, sulphur dusting against powdery mildew is necessary.

In inland districts, anthracnose is the worst problem and good disease control can often be obtained with one or two applications of a suitable fungicide.

Most of the State's commercial plantings are on the southern highlands around Stanthorpe. There the altitude (2,500 to 3,500 ft. above sea level) and the medium though erratic rainfall frequently combine to give conditions favouring development of all three major diseases.

In all districts, diseases can usually be kept well under control by proper attention to crop hygiene, and spraying and dusting. This is particularly so in commercial vineyards where vines are well spaced, well pruned, and generally well grown. In small home vineyards, vines are often grown on the side of a building, or on an overhead trellis, are often part-shaded, and often cannot be properly pruned and sprayed. Under those conditions it is almost impossible to get good disease control and people who must plant under such conditions should be prepared to sacrifice high fruit quality in favour of fair quality fruit from a vine which is inherently more disease resistant. Isabella is one variety recommended for difficult conditions.

The following pages contain firstly a brief key to the diseases, then descriptions of important diseases, and finally a schedule of sprays recommended throughout the year, with some notes on the preparation of these sprays.

Diagnosis from the key should always be checked with the fuller description of the disease.

KEY TO GRAPE DISEASES

I. Leaves:

- Leaves malformed
  - Numerous black spots .... **Anthracnose.**
  - Leaf margins deeply notched
    - with excessive branching .... **Fan leaf.**
    - with distorted veins .... **Hormone injury.**
- Leaves not malformed
  - No mould growth on surface
    - dead brown area .... **Downy mildew.**
    - small dead black areas .... **Anthracnose.**
  - Mould present
    - white growth on lower surface .... **Downy mildew.**
    - grey growth on upper surface .... **Powdery mildew.**

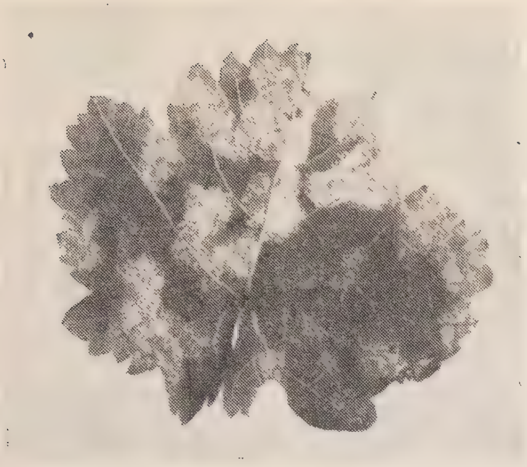

Plate 1

Downy Mildew. An early stage showing the fungus sporing on the under surface of the leaf.

II. Stems:

- Distinct spots or cankers .... **Anthracnose.**
- No distinct spots or cankers
  - Excessive branching .... **Fan leaf.**
  - Stunting (with grey mildew) .... **Powdery mildew.**
  - Dieback of canes .... **Dead arm.**

III. Fruit:

- Size irregular .... **Hen and Chickens.**
- Size more or less regular
  - No mould growth on surface
    - spots on berries
      - minute black specks .... **Bitter rot.**
      - small, sunken, black spots .... **Anthracnose.**
      - large blotches .... **Downy mildew.**
      - skin cracking and hardening .... **Powdery mildew.**
  - Mould present
    - fine grey powder .... **Powdery mildew.**
    - furry grey mould .... **Grey mould rot.**

DOWNY MILDEW

Downy mildew disease attacks foliage mainly but sometimes shoots, tendrils and fruit are affected.

On *leaves* the first symptom is usually a light spotting of the older foliage. This spreads to affect more and more leaf area and younger leaves. The fungus, *Plasmopara viticola,* which causes downy mildew spreads rapidly in cool, moist weather and develops a visible white mildew on the spots, particularly on the under surface of the leaves (Plate 1). If dry weather follows, the spots turn brown and affected leaves shrivel (Plate 2). The final result is death and drop of these leaves and a vine may even be completely defoliated.

When *shoots* and *tendrils* are attacked, usually early in the season, they become stunted and contorted, sometimes with slightly depressed, water-soaked areas. Occasionally the white mildew forms on them.

Affected *fruit* show large, rather oily blotches with a dark margin. They then wither and fall easily.

All grape varieties are more or less affected by downy mildew. Particularly so are vinifera (or European) varieties such as Muscat Hamburg, Waltham Cross and Purple Cornichon, which constitute the great majority of plantings in Queensland. The American varieties, represented here by Isabella and some root-stocks, are less susceptible.

The white mildew that appears on the surface of infected leaves consists of a mixture of spores and their supporting branches. These spores wash and blow readily to fresh leaves and there, in moist conditions, they germinate and grow down into the plant.

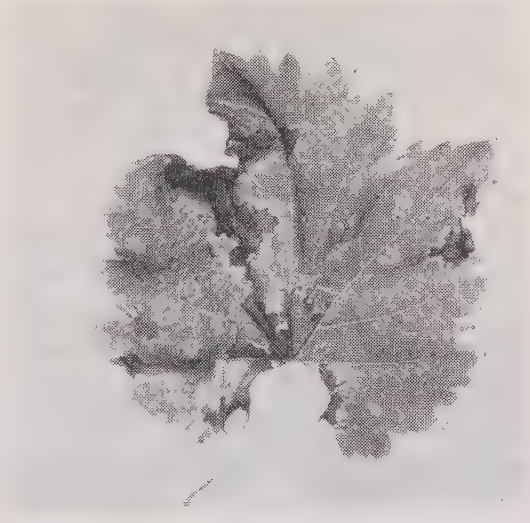

Plate 2

Downy Mildew. A later stage showing dried spots.

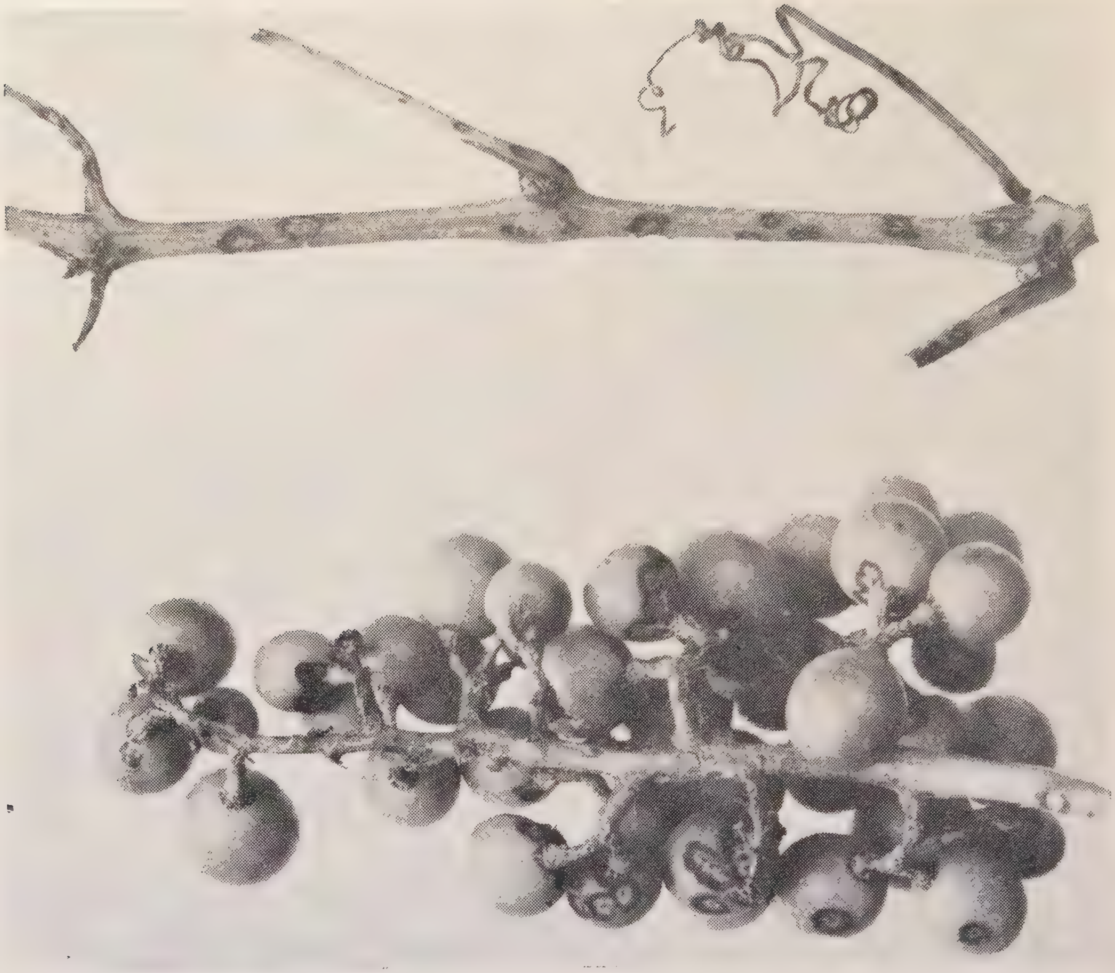

Plate 3

Anthracnose.

The fungus continues to grow there, feeding on the tissues, and appearing on the surface only to form more spores. In autumn another type of spore is found inside the tissue. This has a thick wall, survives the winter inside fallen leaves, and starts infection again next season.

Control

The starting point in control is a thorough clean-up during winter. All prunings, fallen leaves, and remains of fruit should be burnt or well buried in order to minimise sources of infection for the coming season.

This hygiene needs to be supplemented by spraying with 10:10:100 Bordeaux mixture. In districts where the disease occurs regularly, spraying should not be neglected and should start when the shoots are 6 to 8 in. long. This gives a cover of fungicide on the foliage to prevent germination of spores and entry by the fungus. Around Stanthorpe the spray must be repeated at intervals of 2 or 3 weeks to protect new growth and renew the cover on older portions. More frequent spraying is necessary when the weather is likely to be showery, especially on the coast. There, weekly spraying may be necessary.

Do not spray while the grapes are in flower. If spraying is needed then it should be delayed until the berries have set. Similarly, do not spray as the berries ripen. Otherwise they will carry undesirable residues and may be unmarketable.

ANTHRACNOSE

Anthracnose or "black spot" attacks all young parts of the vine, especially new shoots and fruit. On *leaves,* infections are at first small and very dark brown. As the leaves grow so do the spots, the centres of which become lighter and often eventually fall out. Distortion is usual if there are many spots or if the veins are involved.

The most serious and most conspicuous symptoms are on the *shoots.* There, small brown spots grow and multiply into elliptical sunken cankers with black edges but lighter centres. Growth is deformed and restricted. If fruit stalks are attacked the fruit usually do not develop. On the *fruit* themselves the trouble is easily distinguished from other diseases as older spots have a grey centre and the black edge is often tinged with red (Plate 3).

The disease is caused by a fungus, *Elsinoe ampelina.* It grows internally and is quiescent in autumn and winter but produces masses of tiny spores in the spring and early summer. These wash on to healthy young tissues and infect them. Some varieties, notably Gros Colman and Royal Ascot, are resistant as also are American varieties grown here. But Waltham Cross and Purple Cornichon are susceptible.

Control

Again a thorough clean-up during winter is the key to success. All cankered canes should be pruned out and all prunings, fallen leaves, and fruit debris should be burnt or well buried to cut down sources of infection.

This vineyard hygiene must be followed by a spray programme. This must start early because young tissues are so liable to attack. General practice in Queensland is to start at bud-burst, but experience elsewhere suggests that an additional spray at the first sign of bud movement (bud-swell) could be worthwhile. For these sprays ziram or thiram (1½ lb. in 100 gal.) should be used but Bordeaux (10:10:100) can be substituted for foliage sprays in districts where downy mildew occurs. Usually a total of three sprays are sufficient but extra protection may be needed if moist weather occurs during flowering and fruit set.

POWDERY MILDEW

Powdery mildew is often called "oidium," especially in continental Europe. It may be found on any new tissues but is most usually seen on the top sides of *leaves.* At first it shows as one or more indistinct white patches. These spread, finally covering the leaf, and take on a powdery appearance so that the entire upper surface of a leaf has a light grey dusty coating. On *stems* the general appearance is the same but the spots are not usually extensive. If the *fruit* are attacked the powdery condition may not always be seen; the berries are russetted, become misshapen and sometimes crack (Plate 4).

A fungus, *Uncinula necator,* causes this disease. It lives mostly on the surface of the plant but sends in short feeding tubes. The "dust" consists of myriads of spores, which blow about and rapidly spread the disease.

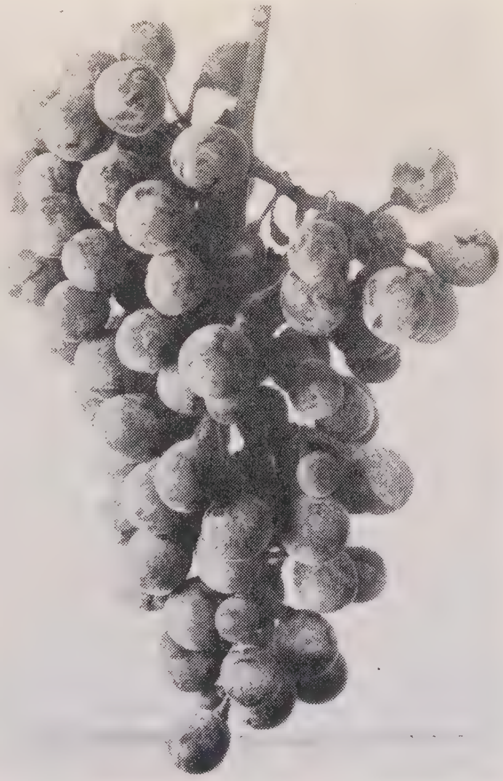

Plate 4

Powdery Mildew. Serious fruit infection showing mildew on the berries.

Control

The fungus is not controlled by the sprays used for downy mildew or anthracnose. Sulphur is still the standard control and can be sprayed or dusted. Normally "sulphur-ing" starts when warmer weather comes at about flowering time, but sprays should not be used during the actual flowering; sulphur dust can, however, be used and is thought to improve fruit set in some varieties. Commonly three to five applications are sufficient.

FRUIT ROTS

Several diseases can attack grape berries during ripening. Usually these follow other diseases and insect injuries, and are aggravated by wet weather. The common fruit rots are bitter rot and grey mould rot.

Bitter rot, *Melanconium fuligineum,* results in berries becoming darker than usual and covered with tiny black spots. It often follows downy mildew.

The symptoms of grey mould rot, *Botrytis cinerea,* are well described by its name. It occurs only during long wet periods and commonly affects every bunch. At best, therefore, marketable grapes are obtained only after much trimming—an expensive operation.

Control

Experiments have shown that sprays control grey mould rot but tend to leave residues that make the fruit just as unmarketable. Sprays such as captan or zineb can be used but care must be taken not to spray close to harvest.

An indirect way of lessening losses is to use several varieties in planting a vineyard. Selecting these to ripen at different times will reduce the risk from having large numbers of a susceptible variety maturing during a wet period. It also spreads the work of marketing.

DEAD ARM

Dead arm occurs occasionally in coastal districts. It is caused by a fungus, *Phomopsis viticola,* a wound parasite that enters injuries or large pruning cuts and develops in the vine. Beyond the injury, the vine becomes unthrifty and finally dies. Affected parts should be cut away well below visible infection and the cut treated with grafting mastic.

HEN AND CHICKENS

In addition to the fungous diseases mentioned earlier, grapes are subject to deficiency disorders. The most important of these in Queensland is hen and chickens. This is characterised by the production of many undersized berries, scattered among which there are usually several full-sized fruit.

Control

This disorder is not yet fully understood, but in many instances benefit results from applying borax to the soil around the vine in late winter or early spring at the rate of 1 oz. per vine. Alternatively a borax spray, 5 lb. in 100 gal. of water, may be applied 3 weeks before flowering.

VIRUS DISEASES

Grapes are subject to several virus diseases that can result in death or unthriftiness; few of these are definitely known to occur in Australia. That is one reason why growers should preach and practice plant quarantine. Cuttings brought into the country by over-zealous visitors should be destroyed forthwith. There have been a few instances of a disorder resembling the virus disease known in California as fan leaf, and in Europe as roncet, court-noué, urticado and Reisigkrankheit. It is characterised by excessive branching, together with shortening of the internodes and production of deeply-notched leaves. Any vine showing these symptoms should be avoided as scion material. Care should be taken to avoid confusing this disease with injury from hormone weed-killers.

HORMONE INJURY

Grapes are extremely susceptible to damage by even very low strengths of the hormone-type chemicals commonly used for weed killing, and sometimes for fruit setting and fruit thinning. A characteristic symptom is the production of misshapen leaves, commonly deeply notched and always with the veins contorted into a close zig-zag (Plate 5).

Unless the injury is so severe as to kill the vines very quickly, they usually recover, but the season's crop may be lost or seriously reduced.

Every care should be taken that these chemicals, especially those used as weedkillers, are not used near grapes or where wind drift could conceivably carry them on to grapes. The chemicals are very persistent in spray vats, pump, and hoses, so that hormone weedkillers should never be used in ordinary spray outfits—a special spray should be kept for the purpose.

SPRAY SCHEDULE FOR GRAPES

Time of Application	Diseases	Spray
Bud-swell (susceptible varieties) . .	Anthracnose (black spot)	Ziram 1½lb.–100 gal. *or* Thiram 1½ lb.–100 gal.
Bud-burst	Anthracnose . .	Ziram (1½ lb.–100 gal.) *or* Thiram (1½ lb.–100 gal.)
Shoots 6″–8″ long	Downy mildew anthracnose	Bordeaux (10 : 10 : 100). If downy mildew not important use— Ziram 1½ lb.–100 gal. *or* Thiram 1½ lb.–100 gal.
And thereafter as required (about fortnightly)	Downy mildew anthracnose	Bordeaux (10 : 10 : 100)—Do nor use Bordeaux while flowering or as berries ripen. If downy mldew not important use— Thiram (1½ lb.–100 gal.) *or* Ziram (1½ lb.–100 gal.)
As required	Powdery mildew . .	Colloidal Sulphur *or* Sulphur dust

PREPARATION OF SPRAYS

Bordeaux Mixture

The formula quoted with Bordeaux mixture refers to the quantities of bluestone, lime and water. Thus 10:10:100 means 10 lb. bluestone, 10 lb. burnt or hydrated lime and 100 gal. of water.

In preparing Bordeaux mixture, be careful to dissolve the bluestone and lime separately, each in a large volume of water, and then mix the cool, dilute solutions. Make up to the correct volume with water if necessary. The bluestone should be dissolved in a wooden or copper vessel as the chemical corrodes iron. The lime should be fresh. Use freshly prepared spray.

Bordeaux mixture cannot be mixed with some types of DDT. If combination sprays containing these are required, a proprietary copper spray must be used.

Proprietary Copper Sprays

Though more expensive than, and in some ways not so efficient as, Bordeaux mixture, proprietary copper sprays are commonly used for ease of handling, particularly on small jobs. Mixing directions on packages should be followed to give the equivalent of the recommended Bordeaux mixture. A proprietary material containing 50 per cent. copper should be used at the rate of 5 lb. in 100 gal. to correspond to 10:10:100 Bordeaux mixture.

Other Sprays

Most other materials recommended here are sold as powders in packets containing enough to make 100 gal. of spray at normal strength. Usually it is best to mix the powder with a little water to give a paste, then dilute it and add it to the bulk of water in the vat. Adding much water to the vat after adding the chemical may cause excessive frothing and should be avoided.

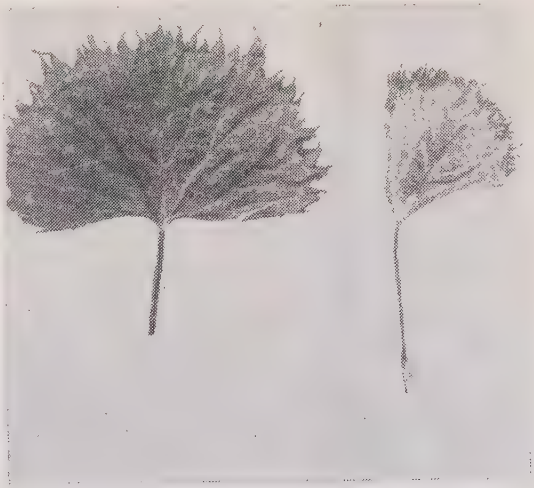

Plate 5

Hormone Weedkiller Injury. Serious (left) and extreme (right) type of injury.

Big Loss From New Fowl Disease

By P. D. RANBY, Divisional Veterinary Officer (Poultry Diseases).

A poultry disease new to Australia has carried off more than 700 fowls in one flock in Queensland in less than 6 weeks. It is a septicaemic disease caused by a streptococcus.

The outbreak occurred in a flock of 1,400 laying hens at Redcliffe towards the end of last year. In 38 days, 55·3 per cent. of the flock died.

In treating the disease, best results were obtained by feeding furazolidone in the mash. In untreated birds, deaths were so rapid that few were seen sick. On three occasions, furazolidone was fed in the mash at the rate of 0·02 to 0·03 per cent. This reduced the death rate dramatically, but many cases of sickness appeared during the early stages of treatment. Sick cases showed variable temperatures up to 110 deg., and many stood in a state of "sleepy sickness". Many of these cases died after several days. These could be regarded as a less severe form of the disease. Continued furazolidone treatment halted new cases but relapses occurred when the drug was stopped.

On the second occasion that furazolidone was used, treated birds were compared with a smaller group of untreated birds. Losses continued in the untreated pen. Injections of a triple penicillin at 15,000 units a bird appeared to be of no value.

Post-mortem findings varied. In birds that died rapidly (in a few hours), lesions were often absent. Some cases surviving longer showed swollen livers, while a breakdown of developing eggs (ova), and sever peritonitis were common. In all cases, however, streptococci were present in the internal organs. The organism was readily transmitted in the laboratory to experimental birds. The source of the infection could not be determined. Although outbreaks of streptococcosis have been reported in mature fowls overseas, this appears to be the first outbreak reported in Australia.

This disease strikes so suddenly that no time should be lost in treating affected flocks. When sudden, mysterious deaths occur in a flock, a farmer should seek veterinary advice at once.

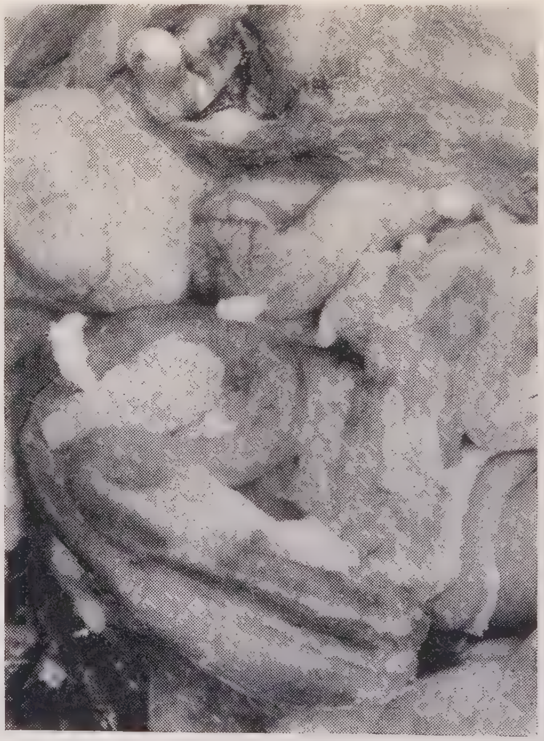

Plate 1

Abdomen of a Hen that Died From *Streptococcal septicaemia.* A developing egg yolk (top left) has lost its round shape and contains pus. Coagulated material is seen thickly coating the intestines (fibrinous peritonitis).

Grape Pest Control In The Granite Belt

By M. BENGSTON, Entomologist.

Efficient pest control is essential for the successful production of grapes in the Granite Belt. Pest activity each year is consistent enough to warrant routine protective measures, which are presented as a generalised control programme. An understanding of the pest concerned will help the orchardist to evolve a programme suited to his particular needs.

Grape Scale

Typical infestations of grape scale first occur on a few adjacent vines.

This large, dark-brown oval scale forms clusters along the canes where it feeds by sucking sap. Affected vines are weakened and may even be killed. A black coating of sooty mould grows on secretions from the scale making an unsightly deposit on vines and fruit.

The grape scale overwinters as immature females on canes or under the bark of older wood. These mature during spring and each then lays several hundred eggs. Crawlers emerge in early summer, and then move to new wood where they settle down to feed.

Grape scale is best controlled by a winter oil spray, either red oil 5 parts in 100 of water while vines are fully dormant, or superior oil 3 parts in 100 at any time from full dormancy till just before bud movement. The use of superior oil has the advantage that this material may be combined with the lime sulphur spray for mites.

Rust Mite

Rust mites are too small to be seen with the naked eye but with the aid of a hand lens can be distinguished as cream-coloured torpedo shaped objects. They are found mainly on the upper surface of the leaf where they feed by puncturing the surface cells and sucking the juices. Affected leaves first show a pale discolouration along the main veins. This later becomes brown and spreads over the leaf surface. Severe infestations, which are most likely in hot dry seasons, cause severe premature leaf fall.

The mites overwinter in the grape buds where adults begin egg laying in the spring. The young move to the leaves for feeding and there are many generations each season.

Lime sulphur 5 parts in 100 of water just before bud movement, followed by cover sprays of sulphur at standard strengths, as used against downy mildew, will control mites.

Light-Brown Apple Moth

Larvae of the light-brown apple moth are recognised by their characteristic fast wriggling action and the habit of parachuting on a strand of silk when disturbed. They web leaves together and build silken galleries inside the bunches. Bunch damage may be serious because it increases susceptibility to grey mould rot.

Light-brown apple moth has a wide host range. In the Granite Belt it occurs also on apples, pears, peaches, plums, apricots and lupins. It has no particular overwintering stage but breeds slowly through the winter on available hosts.

Satisfactory control may be achieved with a spray programme of three applications. Lead arsenate, 3 lb. in 100 gal. of water, should be applied when shoots are 6 to 8 in. long, and again just before flowering. This is followed by DDD 0·1 per cent. about 3 to 4 weeks after flowering. This last spray should be directed into the bunches.

Leaf-eating Moths

The larvae of several species of moths attack grape vines. These leaf eaters can rapidly defoliate the vines and ruin young bunches.

The conspicuous black and yellow grape vine moth is about 2 in. across the wings. The larvae are at first mainly black but later develop yellow, green and red markings. They grow to about 2 in. in length.

Hawk moths are large, brownish, and swift fliers. Their grey-green larvae, which may grow to a length of 3 in. are easily recognised by a prominent, curved terminal spine.

The routine applications of lead arsenate before flowering and DDD after flowering as discussed under light-brown apple moth are normally sufficient to control these pests. Should they become active after harvesting has been completed, an additional spray of lead arsenate may be required.

Grape Thrips

Thrips are present in small numbers in most grape blossom and may also feed on young foliage. These are elongate insects about one-sixteenth of an inch in length, the nymphs being cream and the adults dark grey to black. They are very active and migrate to the particular flowers that are in full bloom: heavy infestation may cause poor setting.

Thrips are best controlled by a 2·0 per cent. DDT dust applied during flowering.

Phylloxera

The serious pest, phylloxera, does not occur in the Granite Belt. Quarantine regulations prohibit the entry of grape planting material from infested areas.

The choice of rootstocks for grapes is influenced necessarily by horticultural considerations, but the use of phylloxera-resistant rootstocks is desirable.

Control Programme

Time of Application	Pests	Sprays and Dust
Dormant	Scale	Superior oil 3/100 gal. or Red oil 5/100 gal.
Just before bud movement	Rust mite, scale	Lime sulphur 5/100 gal. plus Superior oil 3/100 gal. (if oil not previously applied)
Shoots 6 to 8 in. long	Light-brown apple moth, leaf-eating moths	Lead arsenate 3 lb./100 gal.
Just before flowering	Light-brown apple moth, leaf-eating moths	Lead arsenate 3 lb./100 gal.
At flowering	Thrips	DDT 2% dust
3 to 4 weeks after flowering	Light-brown apple moth	DDD (TDE) 0·1%
Cover sprays	Rust mite	Sulphur

Scientific Names

Grape scale	*Eulecanium persicae* (Geoff.)
Grape thrips	*Haplothrips froggatti* Hood.
Grape vine moth ..	*Phalaenoides glycine* Lew.
Light-brown apple moth	*Austrotortrix postvittana* (Walk.)
Hawk moths	*Hippotion celerio* (L.) and *Theretra oldenlandiae* (Fabr.)
Rust mite	*Calepitrimerus vitis* (Nalepa)
Phylloxera	*Phylloxera vitifoliae* (Fitch)

Controlling Insect Pests Of Bananas In North Queensland

By G. W. SAUNDERS, Entomologist.

The banana grower has to contend with several insects which attack the roots, leaves and fruit of the growing plants. The importance of these may vary considerably from year to year according to seasonal conditions and biological factors. Some of the pests are present on most plantations every year, and may be dealt with as required.

The most consistent pests are the banana rust thrips. These insects are more prevalent in hot weather, particularly during January, February and March. The thrips feed on the surface skin between young fruit, causing damage first apparent as a smokiness which becomes evident as a rust as the fruit matures.

Caterpillars of the scab moth cause surface damage on young fruit and the resulting scab reduces market value. Scab moth appears worse in close proximity to standing scrub, and is most active during the period February to May. The adult moths of this pest lay their eggs on the leaf bases and the young larvae crawl along the bunch stalk to reach the fruit and flowers on which they feed.

Banana weevil borer generally is not regarded as a serious pest in north Queensland because severe damage is caused mainly in neglected plantations, or in drought years. However, serious damage can follow the use of borer-infested planting material.

The banana fruit fly can be an important pest in plantations north of Cardwell. The fruit may be stung while still green and the attack often centres on individual bunches. Fruit fly incidence is closely related to weather conditions and is higher during warm weather. The presence of ripe or damaged fruit often is responsible for fruit fly infestation in a plantation.

White grubs are minor pests of bananas, but in isolated instances cause severe damage to plant roots.

Red spider mites may build up on leaf undersurfaces and on fruit in dry periods or following excessive and injudicious use of insecticides. Leaf yellowing is a common symptom which may be followed by leaf fall. Heavy infestations may cause a rusty appearance of the fruit, usually on the more exposed surfaces.

Control

Careful selection of planting material is necessary to ensure healthy growth in the early life of the plant. It is advisable to pare the roots away until clean fresh corm tissue is exposed. Any borer-infested material should be removed or the bit or sucker discarded.

After the first shoot appears, apply 2 oz. of a 10 per cent. BHC dust (1·3 per cent. gamma isomer) to the soil around the plant. This should be spread in a band 2 ft. wide, not closer than 1 ft. from the plant, and lightly chipped in. Treatment made before October each year will prevent white grub damage and minimise weevil borer attacks.

As soon as the tip of the bunch appears in the throat of the plant, DDT–BHC dust applications should commence for control of scab moth caterpillars and thrips. A composite DDT (2·0 per cent. p.p′ -isomer) dust should be applied weekly for 3 weeks. It is essential to maintain a coating of insecticide on the bunch stalk and throat of the plant up to the time that the bunch is fully opened. During continuous wet weather, twice weekly applications may be necessary. Further applications can be made as required for scab moth caterpillars or at fortnightly intervals should thrips activity continue.

A DDT spray at a strength of 0·1 per cent. may be used in place of the DDT–BHC dust. Care should be taken to ensure that the fruit only are treated, because continuous insecticide treatment of the leaves may lead to a build-up of red spider mites.

Red spider outbreaks may be controlled with sulphur dust or sprays. This treatment should rarely be necessary, because natural control by predators, if not interfered with, usually is effective.

Plantation hygiene practices cannot be overstressed. The main benefit to be derived is lower incidence of weevil borer and fruit fly. The adult weevil borers are attracted to exposed surfaces of cut or broken stalks. These may be treated with 10·0 per cent. BHC dust. As fruit

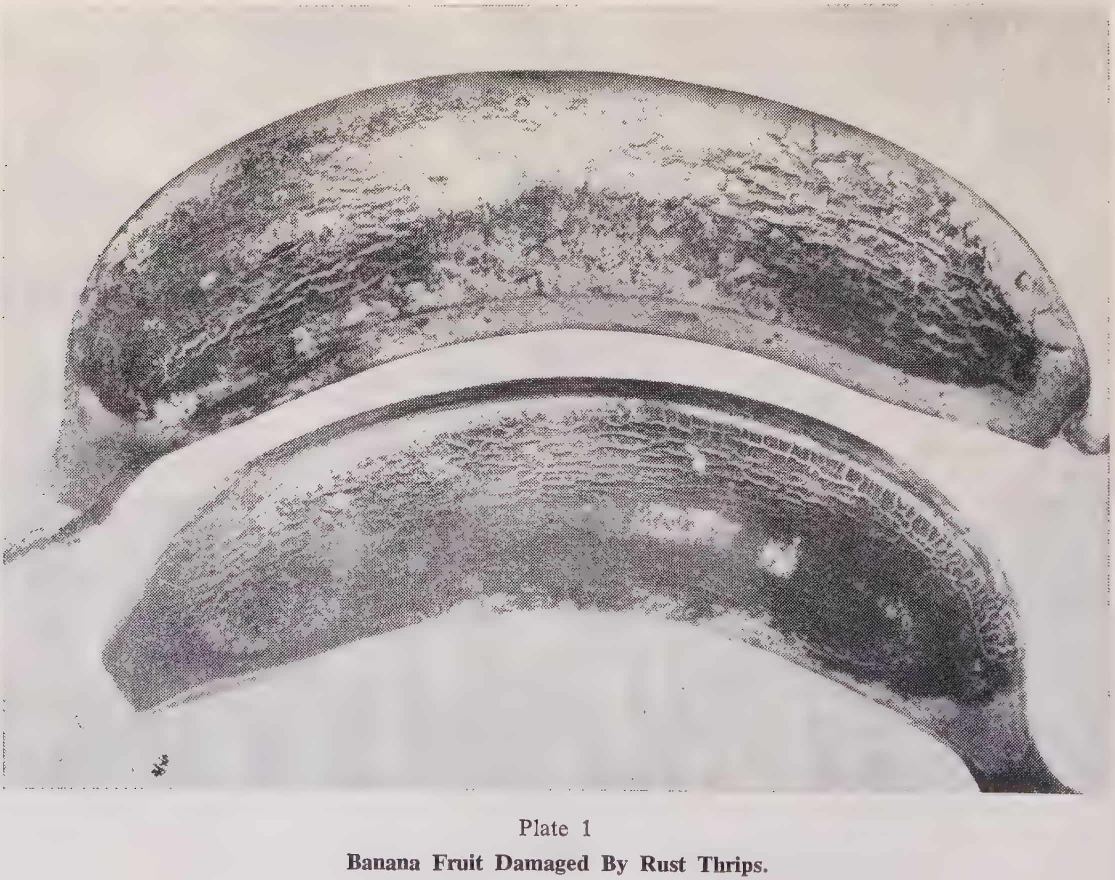

Plate 1

Banana Fruit Damaged By Rust Thrips.

fly is attracted to the plantation by ripe or damaged fruit, defoliated ratoon plants liable to ripen their bunches prematurely during the spring should receive early and special attention. Where fruit flies are prevalent, early harvesting of bunches may be necessary.

Control applications for minor pests are seldom warranted. Insecticides should be used only when necessary and must in no way replace plantation management.

Warning

Severe burning and spotting of fruit may follow the use of certain insecticides, or the injudicious use of those insecticides recommended here. Dusting machinery should ensure an even flow of dust at the outlet so that caking of large deposits on the fruit is avoided.

The application of insecticide sprays and dusts is hampered by wet weather at the time of the year when pests are likely to be prevalent. For this reason great care is required in the methods used, and the manner in which sprays and dusts are applied.

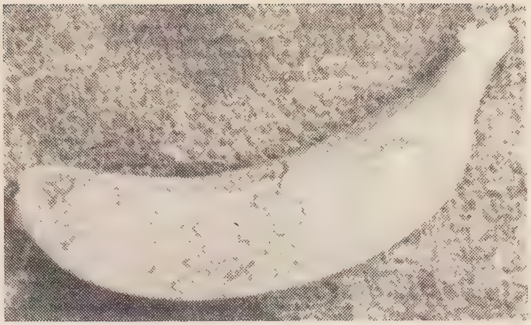

Plate 2

Banana Fruit Damaged by Scab Moth Caterpillars.

Insecticide applications if continued on fruit should cease 3 weeks before harvesting.

Banana rust thrips . .	*Scirtothrips signipennis* Bagn.
Scab moth	*Nacoleia octasema* (Meyr.)
Banana weevil borer . .	*Cosmopolites sordidus* Germ.
White grubs	*Melolonthidae*
Red spider mites . .	*Tetranychidae*
Banana fruit fly . .	*Strumeta musae* (Tryon)

* * *

QUEENSLAND BUSH BOOK CLUB

The Queensland Bush Book Club will supply reading material to anyone living beyond the reach of a town library.

For a fee of 3s. 6d. a year, subscribers may receive parcels of 10 books, and some magazines and illustrated papers.

Parcels will be consigned to the subscriber free of cost to the nearest railway station but subscribers will make their own arrangements for delivery from the station.

Each parcel contains about 3 months reading but exchanges may be made more often if required.

Write to Secretary, Bush Book Club, Victory Chambers, Adelaide Street, Brisbane, enclosing 3s. 6d. and you will be enrolled as a member.

If living north of St. Lawrence write to Bush Book Club, Box 475 G.P.O., Townsville, and if in the Brisbane Valley to Bush Book Club, Ipswich.

Buying Storage Units.—The great variety of cupboards and cabinets now available makes it possible for most home owners to provide adequate and more convenient storage space.

Whatever the type of cupboard or cabinet, it should be purchased for the particular use required, and the unit needs careful examination to ensure its value and suitability.

Miss Nancy Foskett, Senior Extension Officer, Women's Service, N.S.W. Department of Agriculture, suggests some things to consider when buying storage units:

Space within the unit should be so shelved, partitioned and divided, that articles can be stored to the best advantage—conveniently and economically.

Adjustable shelving can be an advantage.

A cupboard 10 to 12 in. deep is generally more satisfactory than one 20 in. deep. As the same amount of room is not needed to get to articles at the back of a narrow shelf, shelving can be closer —therefore, there can be more shelves and so more storage.

Overall dimensions of the unit in relation to size of room, and size of other furniture, are important.

Height of the upper shelves should be considered in relation to the height of the person who will be using them most.

Material used, and finish, should fit in with other furnishings.

Structural sturdiness is essential—if to be free-standing, the unit must not be top-heavy.

Legs should be securely attached, steady, and sturdy enough for the weight of the cabinet *when full.*

Pay particular attention to doors.

Two 10 in. doors are better than one 20 in. door on overhead cupboards.

Make sure hinges are strong enough to hold the weight of the door.

See that hinge fitting ensures flush fitting of door on hinged side. In some cases hinges need to be set-in on door and frame.

Check that stoppers are fitted to the running tracks of sliding doors to prevent pinching of fingers when the doors are opened.

See that finger-holds on sliding doors are dee enough to allow firm grip, and so avoid broke finger nails.

It is an advantage if sliding doors can b removed for cleaning.

Sorting is Essential.—Unsatisfactory result from mechanical washing in modern washin machines may be caused by careless—or no— sorting of the clothes and articles.

Modern washers do a fine job for the home maker, particularly in reducing fatigue, but the cannot produce a good coloured wash if we tos in a collection of unsorted clothing and articles press a few buttons and go on our way.

There is as great need to sort clothes for th washing machine as for the wash-tub and coppe

Sort according to:

- Type of fabric.
- Colour of fabric.
- Temperature of water.
- Washing time.
- Degree and type of soil.
- Type of article.

In the pre-synthetic age we sorted into three or four bundles—wool, silk, cotton and linen, and sometimes mixtures. Today we have synthetics and drip-dries to consider, which also call for different handling.

Irrespective of the tremendous improvements in dyeing it is still worth while not to wash whites and coloureds together.

Worth remembering too, is that fresh water for dark colours can be a time-saver as any fluff and dirt in "used" water will spoil the appearance of dark colours.

The temperature of the water should be varied according to fibres and colours.

Start off with cool and add hot, or vice-versa, according to next load if not a fully automatic washer.

Washing time varies according to delicacy of fabric and amount of soil.

Where a load is made up of equally soiled articles, but some are more delicate than others, stop the machine and remove the delicate articles before the time for the heavier articles is up.

Any stains should be removed before washing, while soaking or a longer wash period will look after many soiled articles.

Very soiled articles are better washed in two separate waters rather than twice as long in the one water.

Other precautions.—Close zippers; check for broaches, pins and tears; empty pockets; and tie any strings in a loose knot.

Check on Jobs.—Fatigue, both physical and mental, is to be avoided by home makers for their own and their family's sakes.

An occasional check on how we go about a job or a day's work will often reveal ways to make work easier.

This may be by simply reminding us of points overlooked.

We can remind ourselves by:

Changing the Order of the Job

This may be done by:

- Giving the living-room a quick "tidy-up" each night before going to bed—emptying ash trays, picking up magazines, shaking cushions and putting furniture back in place and sweeping up the fireplace in the winter.

This responsibility should be shared by the members of the family—either turn-about, or a job each.

- Completing, so far as practicable or at least in one area of the house, all the cleaning jobs to be done with any one tool or cleaning material.
- Thinking before starting a job. Save heels by using head.
- Looking around a room for anything you can take with you on your way.
- Washing walls and dusting from the top down.

Making Physical Work Easier

This can be done by the homemaker if she:

- Uses both hands.
- Uses tray mobiles and trolleys.
- Has ball-bearing casters fixed to heavy furniture.
- Uses large body muscles for pushing, lifting or carrying.
- Bends her knees instead of her back.
- Uses a firm step ladder instead of reaching and stretching *too* far.
- Finds the speed at which *her* muscles work best.
- Doesn't do all the heavy jobs at once—intersperses them with lighter or sitting down jobs or both.
- Wears comfortable clothing and footwear.
- Takes scattered rest periods.
- Receives help from other members of the family.

—New South Wales Department of Agriculture's "Press Notes."

Brucellosis-Tested Swine Herds (As at 1st April, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Clark, L. D., Greens Creek, Gympie
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton" Stud, Maleny
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warree", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Mannuem Brae" Stud, Mannuem, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Skyring, G. I., "Bellwood" Stud, via Goomeri
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Campbell, P. V., "Lawnhill" Stud, Lamington
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud. Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kunawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn," M.S. 74, Clifton
Kingsford, D., "San Antone", Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., "Topcamp", via Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton," M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Pointon, E., Goomburra, M.S. 869, Allora
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Channel Country Cattle Production

By **K. F. HOWARD**, formerly Senior Adviser in Cattle Husbandry.

Cattle production of the Channel Country is reviewed following two surveys that were made in 1956 and 1958.

The unique natural irrigation system is outlined but floods are described as unreliable and more or less of bonus value. Most of the beef production takes place on the non-flooded areas.

As the annual average rainfall is around 7 in., production per square mile is essentially low.

Soils, vegetation and topography are described. Reference is made to the main methods of property improvement.

Cattle systems are outlined—pointing out that most of the cattle produced are bred within the area.

Breeds and breeding methods are reviewed.

The problems of the Channel Country are mentioned. These include distance from railhead and related disadvantages.

Reference is made to the spectacular production in favourable seasons. It is emphasised that the spasmodic nature of the floods and the low local rainfall preclude a big increase in regular supplies of fat cattle.

Location of Area and Properties

This survey refers to the Channel Country of south-western Queensland. The area described (Plate 1) is that in the vicinity of the lower portions of the Diamantina, Cooper and Bulloo River systems.

The country concerned with the survey includes the Channel Country proper and the adjacent non-flooded areas.

The northern portion of Cooper's Creek and the southern Diamantina area were visited in June, 1956, during a favourable cattle season. The lower Cooper and Bulloo areas were visited in July-August, 1958—in the time of severe drought.

During both visits, 22 properties were visited in the Channel Country proper and adjacent areas.

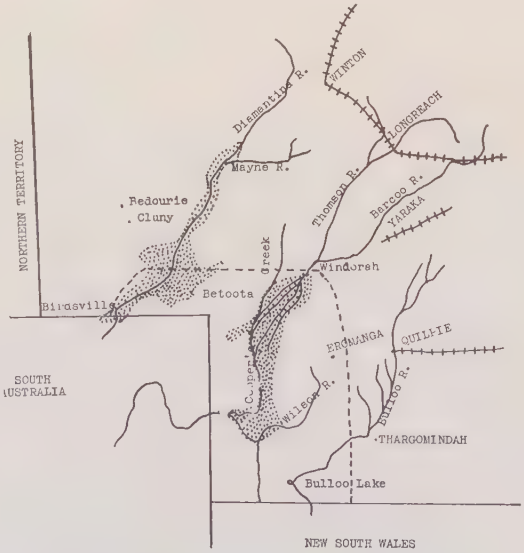
WINTON
Diamentina R.
LONGREACH
Mayne R.
NORTHERN TERRITORY
Bedourie
Cluny
Thomson R.
Barcoo R.
YARAKA
Creek
Windorah
Betoota
Birdsville
EROMANGA
QUILPIE
SOUTH AUSTRALIA
Cooper
Wilson R.
Bulloo R.
THARGOMINDAH
Bulloo Lake
NEW SOUTH WALES

Plate 1

The Area Referred to in this Article is Bounded by the Broken Line and the N.S.W. and S.A. Borders. The dotted area shows the channels of Cooper's Creek and the Diamantina River—Map adapted from Bureau of Investigation—Technical Report No. 1 (1947).

The average size of the properties was in the vicinity of 1,000 square miles. The smallest property was 59,000 acres on the Bulloo River. The largest was a 3,350 square mile property on the Cooper.

River Systems and Topography

The area described includes most of the flooded country of the Diamantina River and Cooper's Creek as well as some properties on the Bulloo and Wilson Rivers.

The majority of the land in the Channel Country is "high" country which is out of flood reach and consequently is dependent on local rain to produce feed.

The unique natural irrigation system of the Channel Country is caused by the backing up of water along a network of channels. These eventually overflow and water spreads out over extensive fertile plains. This is regarded as true Channel Country.

The gradient of the rivers in the Channel area is about 10½ in. per mile.

The Cooper is by far the most important of the Channel systems.

About 90 per cent. of the Cooper River catchment area lies above the 15 in. isohyet with much of its flood waters originating in the upper reaches of the Thomson and Barcoo Rivers. High rainfall at places like Muttaburra, Longreach and Tambo can result in a useful flood.

The flood plain of the Diamantina River is smaller and extensive floods are less frequent than those experienced from the Cooper. Most of the Diamantina catchment lies below the 15 in. isohyet. Local creeks may also provide useful flooding when good local rains are received.

Floods cannot be relied on and occur somewhat spasmodically. The average occurrence of widespread flooding is one every 3 years. Even then the degree of benefit will be governed largely by the time of the year when the flooding occurs.

The country traversed would fall into one of the following classifications:

(*a*) Undulating sandy country with sandhills and claypans

(*b*) Stony downs (or tablelands), stony ridges and low ranges

(*c*) Low flooded clay plains of the channel system

(*d*) Creek flats and swamps

(*e*) Grey to black soil downs

Plate 2

Low Sandhill Country under Drought Conditions Close to the South Australian Border near Innamincka.

Plate 3

Spinifex is a Coarse but Valuable Standing Fodder Reserve during Drought.

Most properties contain a mixture of different classes of soil types.

Only two of the properties visited had more than half of their areas subject to flooding. Many properties had as little as one-fifth subject to flooding, whilst some properties were made up entirely of "high" country.

Climate

The rainfall in the Channel area is low.

The average annual rainfall in the vicinity of the South Australian border is around 6 to 7 in. The annual rainfall increases up to 8 or 9 in. as one moves eastward from the South Australian border towards Thargomindah and Eromanga.

During the 1958 portion of the survey, most of the properties had received little or no effective rain for the previous 2 years. Quite a few properties had received about 2 in. in several falls for 1957 and less than 1 in. for 1958.

The area experiences extremes of temperature. Seasons are very hot. The mean maximum temperature of January-February at Windorah is 99·7 deg. Frosts are experienced in winter. The mean minimum temperature at Windorah for June-July is 44·2 deg.—only 2 deg. warmer than Pittsworth on the Darling Downs.

Soils and Vegetation

The flood plain soils are of heavy grey, self-mulching clay which shrinks in dry times. This results in the appearance of large cracks between aggregates of soil.

The pebbly "tableland" country consists mainly of red clays, while dark grey to black soils characterise the Mitchell grass plains.

Much of the area consists of red sandy soils. Sandhills are common. Many of the sandhills have good pockets of heavier soil between them. Where the sandhills are low, claypans are often found between them but these claypans produce little useful feed.

Timber, shrubs, grass and herbage vary according to type of country.

The high country carries mainly mulga, needlewood, bloodwood gums and whitewood whilst the flooded country or creek flats and watercourses grow gidyea, coolibah, minaritchee and yapunyah.

On much of the pebbly tableland country, practically no timber grows except where sandhills and watercourses occur.

Grasses on the high land are mainly perennials such as silver, never-fail, spinifex and Mitchell (Mitchell occurs on the heavier soils). The sandy country produces very succulent herbage with winter rain.

On the flooded areas, sufficient moisture will produce Flinders, button grass, chlorises and other annuals. A variety of annuals will grow after a March-April flood. These consist mainly of herbage of which the most important plant is Cooper Clover (*Trigonella* spp.)

Shrubs make up a significant portion of the diet. Saltbushes grow on high country whilst lignum and bluebush are found in the swampy areas. Cane grass also grows in the swamps but is not regarded as good feed.

Grazing

Sizable floods produce spectacular amounts of forage but such floods cannot be expected each year. In much of the flooded country weeds also grow in profusion. The green mass of weeds is often mistaken for good stock feed by aerial observers.

Over a number of years it is considered that the high, non-flooded land is more productive.

Local rains produce a great variety of annual and perennial pasture plants.

The high or unflooded country produces quality feed which does not become rank. Such feed retains its nutritive qualities for a long period as there is little rain to cause leaching of nutrients. An amount of feed on the high country is not used even in drought, because of its distance from permanent water.

Saltbush and mulga are a good standby, particularly during drought. Spinifex, too, is regarded as a form of drought reserve.

On the flooded country, bluebush and lignum are eaten when grazing is poor. It is commonly held that lignum often causes deaths in dry times because of the damage done to the beast's digestive system by the hard stems.

Mitchell and Flinders grasses provide good fattening feed on the heavier soils. The sandy soil will produce excellent fattening herbage during the winter after a fall of 1½ to 2 in. of rain.

The most desirable flood is one occurring in March and April. This provides good feed which will fatten cattle for 5 to 6 months over the winter-spring period. Where properties have large areas of flooded country, embarrassment may be caused by having insufficient stores to use the superior feed. This first-class fattening feed will not last long enough for a mob to be mustered and brought down from Northern properties and then fattened on it.

Plate 4

A Dried-out Lagoon. Numerous weak cattle become bogged as water supplies of this nature dry up.

Plate 5

This Type of Bull is Used on a Property West of Hungerford Producing Vealers for the Sydney Market. An inch of rain was responsible for the herbage growth and hence the condition of this animal in midwinter.

Summer floods produce a lot of grasses which are generally coarser and less palatable than the winter feed. Summer floods also produce weeds which are of little or no grazing value.

In a good year, cattle will continue gaining weight throughout the winter months and until September-October.

Systems of Cattle Management

Of the 22 properties visited only four could be regarded as fattening depots in the sense that their major income results from bringing stores onto the property for fattening.

The remaining 18 properties bred most of the cattle they marketed. Two properties bred stores that were forwarded for fattening on properties belonging to the respective companies. One property regularly forwarded a mob of cows and calves into South Australia. Some properties buy stores in addition to breeding.

Most owners preferred to breed their own cattle and fatten them rather than outlay money for stores.

The fattening depots receive stores from northern properties aged from 12 months to 3 years. Most of these are turned off in 1 to 2 years. There is a trend towards getting cattle onto the fattening properties by 2 years of age.

Property Improvements

The basic improvements of water facilities and fencing are likely to make a greater contribution to the area and give a better economic return than any other means of outlay.

Water

Sub-artesian and artesian bores exist in the area. Artesian water has been obtained at depths varying from 900 to 3,000 ft. The supply of water is no simple problem.

On many holdings in the region of the Cooper River there are wells that produce goodly supplies of water at from 80 to 150 ft. On the eastern side of the Cooper, some properties have shallow bores with good supplies but in much of the country that lies east of the Cooper, boring has been unsuccessful.

One property put down 12 bores to a depth of 1,000 ft. only to strike salty water. On Mt. Margaret, one bore was put down to a depth of 5,000 ft. The supply of water was so poor that it was not worth equipping the bore. Bore sinking costs £2 10s. a foot. Permanent holes in the rivers are adequate in a good season but the greatest need for permanent water is apparent in a dry time.

In such cases the feed is generally eaten out for miles around the permanent water.

Where there are no permanent holes, and boring has proved unsuccessful, tanks are the only resort. These have limitations. Tanks that were 30 ft. deep went dry in the 1958 drought. Tank-sinking is being carried out on a number of properties for a cost of 2s. 6d. a cubic yard. The trend is away from the 10 and 15 thousand yard tanks to the 25 and 30 thousand cubic yard tanks. These go to depths of 25 and 30 ft. Some such tanks were dry in early 1958 with no prospect of being filled by late winter. The mineral, copi, is a hindrance to tank-sinkers.

Most properties are aiming at increasing their water supplies. Often when cattle are dying, the properties have some useful feed that is unavailable to cattle because of the distance from water. A possible solution, where boring is risky, is to put down tanks and fence cattle on to them while they contain water. There would then be some feed preserved around the permanent holes for the dry time. One problem in such a case would be to keep wandering stock away from the reserved area.

Fencing

Very few of the properties have completely fenced boundaries. Paddocks for cattle are a rarity, although some properties have bullock paddocks. Others keep the cattle "in hand" for market as they are mustered.

A suitable fence seems to be one with 15 ft. between posts and 2 barbs and 2 plain wires. Such a fence costs from 8s. to 9s. a post or £140 to £160 a mile plus the cost of wire. In difficult areas, fencing costs 10s. a post.

Plate 6

Store Steers Brought on to a Cooper River Property for Fattening.

Plate 7

Mitchell Grass Growing on Stony Downs West of Eromanga.

Yards

A sound management practice in the area is the use of broncho yards. These are used for holding cattle overnight and for branding. They are relatively cheap. Posts are about 4 ft. 6 in. out of the ground carrying 8 wires with 3 ft. to 6 ft. panels. Having ample yards means that after mustering, cattle do not have to be driven excessive distances for yarding and branding. A yard 80 yards square in size could hold about 2,000 head of mixed cattle. In an area where so few cattle are run to the square mile, an abundance of wire yards is convenient and economic.

Without broncho yards, long drives are required to the occasional rail or stub yards. These drives are hard on the cattle, horses and men.

Drafting yards are scarce because of a general shortage of suitable timber and the high cost of erection. A stub yard is constructed of coolibah stubs 8 ft. 6 in. long, which are placed 2 ft. 6in. in the ground. The stubs are placed next to one another so as to form a solid wall of timber which has a slight outward lean.

On the Cooper country there are many spots where sand has a tendency to bank up and eventually cover rail yards.

Some steel, pre-fabricated crushes are being used for inoculating cattle against contagious pleuro pneumonia.

Cattle Production

Shorthorns and Poll Shorthorns predominate in the area. All graziers are not unswerving in their loyalty to Shorthorn breeds. There are two properties that breed Herefords and Poll Herefords. On one bullock-fattening depot, there were a few Zebu cross cattle which appeared to be in superior condition to their Shorthorn mates.

As fences are scanty, it is difficult to maintain pure herds. Where breeding control is not adequately maintained, Shorthorns appear to hold their type more effectively than other breeds.

The Hereford breeders consider that sound breeding control should be practised.

One fattening property was carrying Aberdeen Angus, Hereford and Shorthorn bullocks.

Breeding Policies

Some properties practise speying but on most, numbers are cut down by selling all cows and heifers that are fat. This policy could counter any attempt at breeding improvement because the best cattle (those that fatten quickest) are not retained for breeding. It appears that wider use of speying would be a simple and practical means of assisting the breeding programme as well as cutting down on losses. One property periodically forwards a mob of cows and calves into South Australia. Some properties regularly import top quality bulls. Others keep above-average bulls from their herds. The quality of the cattle could be generally described as good. The big areas with few fences ensure the existence of a proportion of "mickies" which make their significant contribution to the genetic make-up of the herds.

In the good season of 1956, the majority of cattle seen were in exceptionally good condition. Their condition, colour and conformation when combined would prompt the remark that they were of "good quality." Some of the herds are reasonably well bred but the cattle one sees in the Channel Country in a good season generally demonstrate how greatly environmental conditions affect the appearance of stock.

As few managers of properties have an accurate knowledge of the number of breeders they run, it is impossible to give an accurate figure for the average calving percentage in the area. Bulls put into the herd are put in at the supposed rate of 3 or 4 per cent. These, plus "mickies," would ensure a high enough bull percentage. In a good season, it is considered that the calving percentage would be in the vicinity of 70. Though hornless cattle are generally preferred in the area, mechanical dehorning is not practised.

Type of Turn-off

The types of cattle that are marketed vary considerably. Vealers, yearlings, bullocks, fat cows or stores are marketed according to the policy of the property and the season. The sales of fat bullocks provides the main income. Their ages vary from 2 to 10 years but there seems to be an effort to get steers away before they are 4½ years.

Older cattle, dressing over 1,000 lb. are inevitable whilst the properties remain largely unfenced.

Dressed weights would generally range from 550 lb. upwards. Some consignments consist of very big bullocks. One property is known to have forwarded several trucks of bullocks that dressed over 1,400 lb. These trucked at the rate of 14 bullocks to the K waggon. However, one small well-improved property on the New South Wales border markets vealers and yearlings aged 9–18 months. These are sold on the Sydney market and dress from 380 to 450 lb. They are road transported to the railhead at Bourke.

The average type of bullock from the Channel Country appears to be one aged about 4 years, dressing 680 lb. Fat cows average above 550 lb. carcass weight.

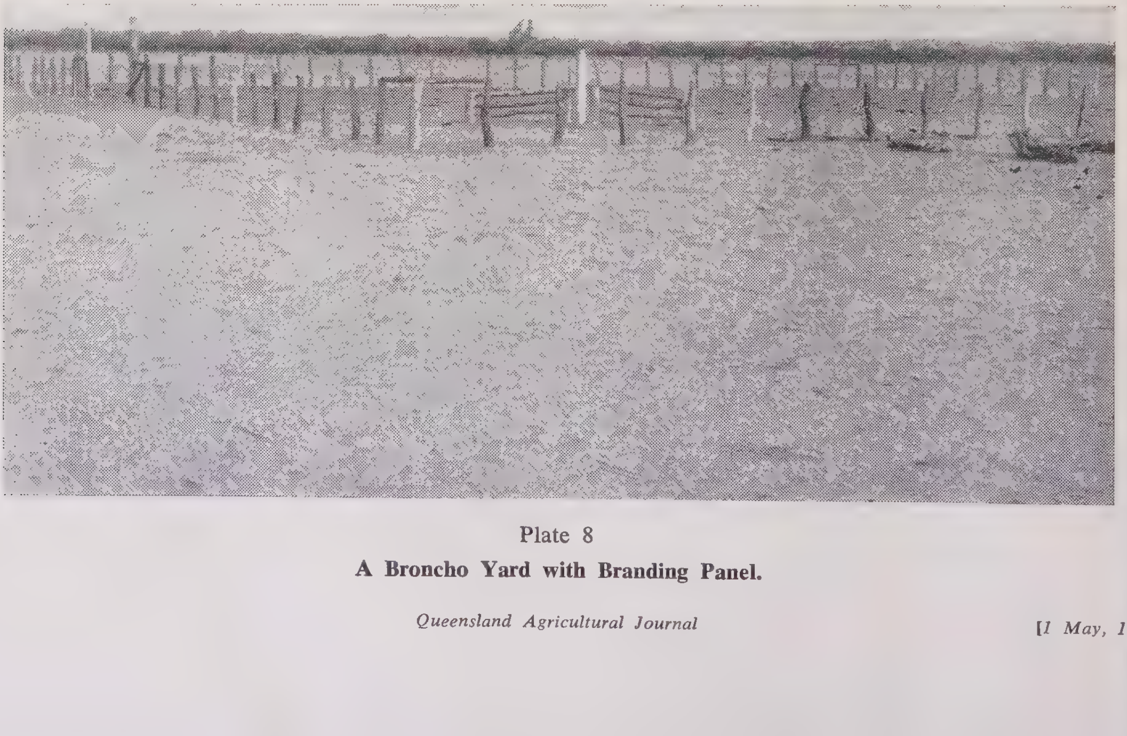

Plate 8

A Broncho Yard with Branding Panel.

Plate 9

Mount Howitt Homestead. Note the radio call sign and property name painted on the roof for identification by aircraft.

Some properties aim at sending away "everything that is fat" including in-calf females. Many of the fat female cattle are not speyed. As a result many calve on their walk to the railhead.

When leaving the property, the slaughter cattle carry more fat than most cattle that are marketed throughout the State. This ensures that, despite the droving trip, they will be well covered on arrival at the meatworks. Channel Country cattle would be fattened for 1 or 2 months longer than would be considered necessary on say, the Western Downs. Cattle that move by road transport to railhead do not require so much finish.

Production per sq. m.

The number of cattle carried per square mile varies from 2·3 head to 14 head. Variation in numbers carried is not always caused by a variation in the type of country. One property visited carried 13 head per sq. m. but had few fats in a dry time and much trouble during drought. An adjoining property carried only 4–5 head per sq. m. but was able to forward fats regularly.

Estimates of carrying capacity appear to convey little useful information. From figures obtained, estimates have been made of carcass beef produced per sq. m. These are very approximate but vary from 400 to 500 lb. The smaller properties generally have a higher production per unit area though one large property compared favourably with the smaller ones.

Clean musters are not possible, which means that the only worthwhile figures are branding numbers and marketing numbers.

Accurate figures of branding percentages are unavailable but the number of calves branded annually would probably range between 50 and 70 per cent. of the breeding cows. There appears to be considerable variation from property to property in the cattle marketed compared with the number branded.

Markets

Places of marketing are determined by the property location, policy of the owner, condition of stock routes and variation in price that is offered.

Properties in the Betoota–Birdsville area prefer to walk cattle down the Marree track and then truck to Adelaide where they are sold by auction. From the Windorah area some cattle walk north-east along the Barcoo Stock route to Yaraka where they truck to Rockhampton.

From the Cooper area, the bulk of the cattle appears to move south. The influence here is mainly the higher prices that are offered on the southern markets. A large number goes to Broken Hill. Some of these may be killed locally or forwarded to the Adelaide market. Some are walked to a meatworks at Bourke. A sizable proportion of the fats are walked eastward to Quilpie and they are railed to Brisbane. Cattle that go to Brisbane are usually bought on the property or auctioned at Cannon Hill.

Where stores are moved off, it is usually from one company property to the other. Stores mostly move south. When conditions are dry, stores are likely to be sold in any direction so long as the price is right and the stock route is fit for travelling.

Stock Transport

Cattle are mainly walked to the railhead at Marree, Broken Hill, Yaraka or Quilpie, or to the meatworks at Bourke. This presents no problem in a good season when there is ample feed and water. Sufficient permanent water seems to be the main problem with stock routes. Travelling is avoided in the hot summer months. During the 1958 drought, road transports were used considerably for transport to the good market existing in Broken Hill. This does not provide a clear solution to the transport problem because the bush tracks would not stand up to consistent, heavy traffic.

In 1958, droving cost £150 a week for a mob of 500 fats. For a 300-mile trip this worked out at 30s. a head. Trucking from Quilpie to Cannon Hill was £78 per K Waggon or about £5 a head. Road transport to Broken Hill cost 10s. a loaded mile or £6 10s. to £8 a steer, according to the size of the steer and the distance of the property from the railhead. Average distances of properties from Broken Hill would be about 300 miles. Droving charge for stores was 5s. 6d. a head per 100 mile.

Plate 10

The Dog-Proof N.S.W.–Queensland Border Fence West of Hungerford.

Plate 11

Cattle of Mixed Ages Fattened on Tanbar Station on the Cooper. Herbage and grasses growing on the high country were the principal foodstuffs.

One grazier in the lower Cooper area estimates that a 700 lb. steer loses £6 value from his property to Adelaide. Road transport means that cattle do not require the same degree of fatness as when they have to walk to railhead. At the time of the survey, a number of stations were sending away small mobs of partially finished cattle that could not have travelled on the dry stock route.

Mustering

Where fences are few, clean musters are almost impossible. One or two men are generally absent from the mustering camp in order to attend the musters on adjoining properties. These "attenders" retrieve the cattle which have been running on the adjoining properties.

As clean musters are mostly out of the question it will be understood that bullocks are often far above the desired age and weight. "Cleanskins" too are often older than they should be. There are however some properties where the cattle are well under control.

When there is no bullock paddock, bullocks are "tailed" and yarded until sufficient numbers have been gathered to form a mob for sending away.

Sizes of fat bullock mobs vary from 500 to 1,200 head.

Smaller properties often combine with another property to form a mob of fats.

Labour

The Windorah, Betoota, Birdsville area has a major task in finding suitable labour. Compared with the north, aborigines are almost an extinct race. Some properties had one or two native stockmen.

The fact that the area is off the beaten track probably accounts for the acute shortage of suitable labour. The work does not appear to be any more difficult than on other stations. The number of men doing stockwork on the properties varied from 4 to 10.

In the lower Cooper and Bulloo areas, labour was more readily available. Men were hired from Thargomindah, Bourke, Broken Hill and Quilpie. Amenities are not great but some effort was made to avoid discontent. Sometimes station personnel will travel over 100 miles to another property for a game of cricket. Amateur races are also conducted. The radio transceivers, Flying Doctor service and plane services have brought the area closer to essential services in point of time than many other areas that are closer to the coast.

Horses

The stockhorses are mainly thoroughbred types. The heavier type of thoroughbred is preferred. Horses on one property had quite an infusion of Clydesdale blood whilst a Percheron stallion was being used as a sire on another property.

Problems of the Area

Birdsville Disease.—This is a major problem in the Windorah, Betoota, Birdsville area. One property visited lost 450 head of horses in 11 years. Another property has to purchase its complement of horses every few years. One manager claims that by fencing off the sandhills in the horse paddock he has overcome the disease.

The life of camp horses and broncho horses is prolonged by periodical hand feeding. The lower Cooper country is not affected with the disease to any great extent.

Dingoes.—Dingoes are plentiful and undoubtedly account for a large proportion of calves. They may not be so great a menace to the cattle industry in this area as is sometimes supposed. Where dingoes were thick, kangaroos were almost non-existent. The New South Wales border consists of a dingo-proof fence. On the New South Wales side, up to 600 or 1,000 kangaroos were seen in a day's driving. This was in contrast with the Queensland side, where not one kangaroo was noticed whilst travelling in the unnetted areas.

On one of the Channel properties, the manager cashed over 500 dingo scalps for 12 months.

It is likely that the losses caused in dead calves would be less than the feed lost to the appetites of large numbers of kangaroos.

Contagious Pleuropneumonia.—Regular vaccination of cattle, at least in breeding properties, is an essential for control of contagious pleuropneumonia. As a general rule vaccination of all store stock is required before they leave the area.

Freight.—Costs are heavy, which means that improvements and stores are dearer than in more accessible areas. The cost of freight on feed may amount to several times the actual cost of the feed. Freight costs vary from £17 to £50 per ton, depending on the situation of the property and the class of freight.

Conclusion

The Channel area is one of large holdings with low returns per sq. m.

Useful floods occur spasmodically and so should be generally regarded as being of bonus value rather than as a reliable source of income.

When good floods provide an abundance of feed, distances are too great to organise the immediate intake of additional mobs of cattle. Stores are walked down from northern areas but most cattle are bred on the properties.

Full use of the "high" country appears to be the soundest investment. Adequate water and fencing are the two methods of improvement that can be used to distribute cattle evenly and so prevent undue concentration of cattle around watering points.

In a normal season, it would appear that cattle make better gains per head in a year than they do on native pastures in areas closer to the coast.

In a good season, profits are considerable but dry times and prolonged droughts make heavy demands on financial resources.

Motor transport has a part to play. This is particularly the case when stock routes are out of commission. Bush tracks, however, will not stand up to constant use by heavy motor transport.

The Channel Country is an interesting and at times spectacular beef producing area. Its contribution to the Australian beef industry is limited by low rainfall, the spasmodic nature of seasons and inaccessibility.

The co-operation and hospitality of the graziers contacted during these surveys is gratefully acknowledged.

Water, Soils And Crops

By A. S. GREASLEY, Agronomist.

This article gives an idea of some fundamental interrelations between soils, water and crop plants and discusses amounts of irrigation water required by plants for their growth.

After a heavy fall of rain, of the water which strikes the surface of the ground, a certain amount will probably run off the area on which it fell. This is called surface drainage. Some will enter the soil and penetrate deeply to find its way eventually to the water tables beyond the normal rooting depths of crop plants. This is known as gravitational water. The remainder will be held in the vicinity of the crop rooting zones in the small soil spaces formerly occupied by air (capillary water), absorbed on clay particles (hygroscopic water) and chemically bound in soil minerals.

Water moves downward into soil as a fairly uniform front (except, of course, in badly cracked soil). Above the front is moist soil, while below it is dry soil. The aim of irrigation is to get this "front" to the bottom of the major portion of the root zone of the particular crop concerned. This is about 3 to 4 ft. for lucerne and 2 ft. for white clover pastures. If it penetrates below the root zone, some of the water will be wasted. If it does not penetrate to the bottom of the root zone, some roots will be in dry soil and may die. This encourages excessively shallow rooting in the crop, leading to the necessity for very frequent irrigations to keep the surface few inches of soil moist.

Because water moves into a soil on a front, a *soil probe* may be used following irrigation to ascertain the effectiveness of the irrigation by determining the depth of wetting. Probes, unfortunately, do not work very well in heavy clay soil because even at permanent wilting point there may be 25 per cent. moisture present, which is sufficient to allow the probe to penetrate the "dry" soil. They are most effective in sands and loams. (See Plate 1.)

The rate at which water enters the soil is called the *infiltration rate*. It is important to have an idea of this rate when designing an irrigation plant. Water sprayed on the ground in excess of the minimum infiltration rate will run off and be wasted.

In most soils the infiltration rate is high initially and it declines progressively as time passes and infiltration proceeds to a fairly uniform minimum infiltration rate. On some soils this minimum rate may be very small and may be practically zero: this is true of some heavy clays.

These infiltration characteristics vary considerably between soil types and they influence the methods of irrigation possible; for example, a soil which has a high initial infiltration rate which does not decline appreciably in a reasonable time (deep sands) is unsuitable for any irrigation method other than spray irrigation. On the other hand, if the topography and the infiltration characteristics are suitable, surface and furrow irrigation methods can be used easily and very economically without excessive use of water.

Loss of Water from Soils

In the absence of plants the losses of water from soil are by deep percolation and surface evaporation. When plants are growing in the soil, transpiration of water through the plant leaves

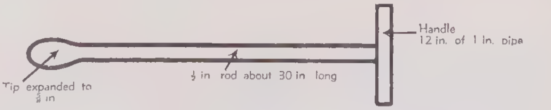

Plate 1

Soil Probe.

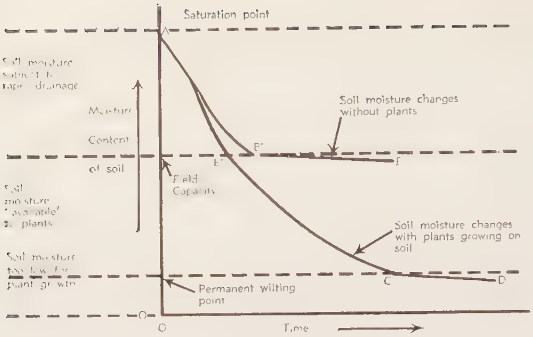

Plate 2

Relations Between Saturation, Field Capacity, Permanent Wilting Point and Moisture Content of Soils.

makes up a considerable proportion of the water loss. In Plate 2 is shown the trends of a soil moisture/time graph both for bare soil and for soil with plants growing.

On this diagram three terms are used to describe various levels of soil moisture, namely, saturated soil, field capacity and permanent wilting point. Definitions of these terms are:

A *saturated soil* is one in which all pore space in the soil is filled with water (for example, the top foot of soil immediately after surface drainage has stopped).

Field capacity is defined as the moisture content of the soil after downward movement of water has ceased.

Permanent wilting point is reached when plants growing in the soil cannot extract any further moisture from the soil and remain wilted even in an atmosphere saturated with moisture.

Another term of importance is *available moisture,* which is in effect the amount of moisture between field capacity and permanent wilting point. This is the moisture which is available to the plants for their growth.

Examples of the amounts of moisture involved in these terms are given in the following table:

——	Sandy Soil	Clay Soil
Field Capacity (% by weight) ..	18%	45%
Permanent Wilting Point (% by weight)	10%	20%
Available Water (% by weight) ..	8%	25%
Available Water per foot depth of soil	1″–1½″	2″–3″

Water in Plants

Of all the materials used by the plant for its growth and maintenance, that taken up in the largest amount is water. The bulk of the water absorbed by the plant through the roots is not retained, however, but evaporates into the air from the leaves. This water loss by evaporation is known as *transpiration.*

The occurrence of transpiration seems to be a natural consequence of the basic facts of plant anatomy. Leaves consist of water-filled cells whose wet surfaces are in intimate contact with the intercellular spaces. These spaces in turn connect through the pores on the leaf surface (stomata) to the atmosphere.

Hence the plant may be rather crudely likened to a wick. Water evaporates from the leaf cells to the atmosphere, is replaced by water brought up through the stem from the roots, which in turn absorb more water by exerting a tension on the soil moisture.

The basic reason for transpiration is connected with photosynthesis, which is the basis of growth of higher plants. In this process, carbon dioxide from the atmosphere is synthesised in the presence of water and light into sugars in the plant cells containing chlorophyll (the green colour of leaves). To absorb the carbon dioxide the leaf cells must expose a moist surface to the atmosphere and in so doing large quantities of water are evaporated or transpired.

Wilting.—The familiar stage of wilting is a result of insufficient water in the plant leaves. The cells lose their turgidity and the leaves droop. There are two types of wilting:

Transient wilting, in which the plant system is limiting; for example, pumpkins on a hot day will wilt in spite of a moist soil because the plant cannot translocate sufficient water to the leaves.

Permanent wilting, in which the soil moisture is limiting. In this case the plants will only recover and become turgid again if water is made available to the plant roots by wetting the soil.

From the plant's point of view the soil may be regarded as a reservoir which is full when the gravitational water has drained away (2 to 3 days after rain) and which is empty when insufficient water remains to prevent wilting; that is, the reservoir capacity is the amount of water between field capacity and permanent wilting point.

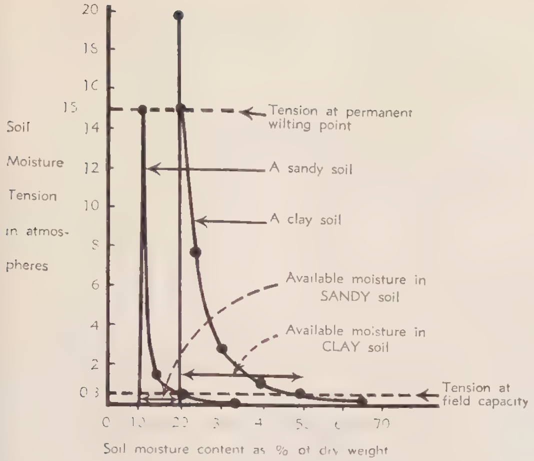

Plate 3

Relations Between Moisture Content of Soils and Moisture Tension. The sandy soil holds little water, the clay soil holds more water.

Water Uptake.—Water uptake by plants is mainly through the very fine actively growing roots. To remove moisture from the soil the plant must exert a *tension*, this tension finally being caused by the evaporation from the leaves.

The tension a plant must exert varies with the moisture content of a particular soil. In general, the wetter the soil the less the tension required, and as the soil dries out the tensions required become progressively greater until finally the plant can no longer exert sufficient tension to remove any of the soil moisture remaining. The tension corresponding to field capacity is about 0·3 atmosphere (1 atmosphere is 14 lb./sq. in.), while that corresponding to permanent wilting point is about 15 atmospheres. The type of relationship between soil moisture percentage and tension is shown in Plate 3.

This diagram shows the very rapid rise in tension corresponding to a very small decline in soil moisture as the soil approaches permanent wilting point. Irrigation should be carried out before this rapid rise of tension occurs because plant growth may be slowed down at the higher tensions. The ideal time to irrigate is probably when about $\frac{1}{3}$ to $\frac{1}{2}$ of the available moisture remains in the soil.

It is helpful to liken this tension/moisture relationship to a sponge dipped in water. Remove it from the water and free water will drain away for a short time (gravitational water gone, leaving the soil at field capacity): squeeze it and quite a deal more water can be obtained initially, but the amount obtained by further squeezing declines rapidly until a time comes when further water cannot be obtained in spite of the pressure exerted (available water gone, and soil at permanent wilting point). At this stage there is still moisture present in the sponge which can only be removed by evaporation or heating (water held in the soil firmly on clay particles or chemically combined in minerals).

The tension required to withdraw water from the soil may be measured by means of a tensiometer. (See Plate 4.) This is a relatively simple instrument which is useful experimentally or in commercial irrigated crops. Unfortunately, it is rather expensive for general use on irrigated farms.

Water Amounts Required By Crops

The relationship between yield of a crop and amount of water applied follows in general a graph similar to that shown in Plate 5. Over the

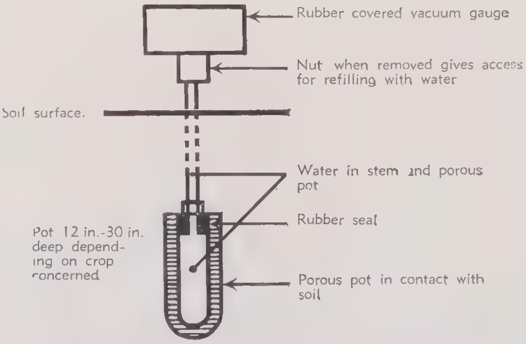
Rubber covered vacuum gauge
Nut when removed gives access for refilling with water
Soil surface.
Water in stem and porous pot
Rubber seal
Pot 12 in.-30 in. deep depending on crop concerned
Porous pot in contact with soil

Plate 4

Soil Moisture Tensiometer. This instrument is designed to measure soil moisture tensions directly and hence give an indication of soil moisture content.

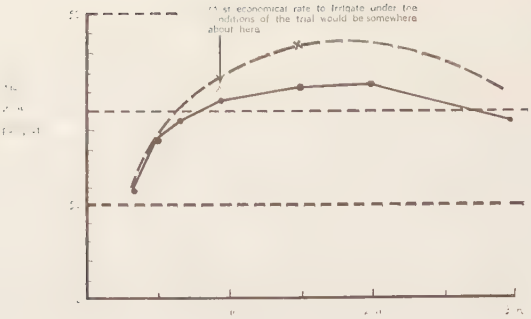

Plate 5

Potato Irrigation Trial. Relations between yield and tubers (first grade) and amount of water supplied by irrigation (no rainfall interfered).

first portion of the graph yield increases with increasing water applied. However, the amount of the increase becomes smaller until finally more water gives no greater yield and in fact may even give a decreased yield due to waterlogging and poor soil aeration. From this graph it may be seen that the maximum economical level to irrigate at would be about 1 in. a week (point A). However, if the fertility of the soil were increased by heavy dressings of fertilizer the economical level could possibly be higher (see dotted graph) and conversely it could be a great deal lower on an unfertilized poor soil.

From this it must be remembered that applying irrigation to a crop might only become an economical proposition if other factors limiting plant growth are removed as well as the limiting factor, water. This means that fertilizer, higher plant populations, better crop management, insect and disease control, better grazing management or haymaking techniques, and better stock might make the difference between an economical irrigation proposition and a "white elephant."

It has been estimated that 1 maize stalk has about 4 pints of water in it at maturity. However, 50 gal. of water are required to bring that plant to maturity, that is, 100 times the amount still present in the plant. This example gives an idea of the large amounts of water which must be thought of when irrigation water is being considered.

As an example, the approximate requirements of lucerne and pasture for south-eastern Queensland conditions are given:

—	Lucerne	Pasture
Depth of major root zone . .	4 ft.	2 ft.
No. of irrigations per year . .	5–6	11–13
Intervals between irrigations—		
winter	6 weeks	3–4 weeks
summer	3–4 weeks	10–14 days
Average irrigation amount . .	4″–5″	1½″–2½″
Total per year (maxium production	60″ (about)	60″ (about)
Total per year (optimum production)	48″	48″
Less rainfall of 30″ irrigation requirement of	about 20″	about 20″

Points To Remember

In irrigation the following points should be remembered:

(1) It is important to give the correct **amount** of irrigation—too much will be wasted by getting below the reach of the roots while too little will mean that some of the crop roots will not be able to contribute to the plant growth because they are still in dry soil.

(2) It is important to irrigate at the correct intervals required by the combination of soil type, crop grown and weather conditions prevailing.

(3) It is important to know—

(*a*) how much water is being put on (pressure gauges, measuring precipitation in jam tins, measuring nozzle outputs, pump outputs and time of irrigation).

A useful formula for the calculation of spray application rates is:

$$\text{application rate (in./hour)} = \frac{\text{g.p.m.} \times 115{\cdot}6}{\text{A}}$$

where g.p.m. is the average nozzle discharge in gal. per min.

A is area covered by one nozzle in sq. ft., that is nozzle spacing × line spacing.

(*b*) What depth of soil was actually wet (soil probe or shovel).

(*c*) When the next irrigation will be required by feel tests on the soil at intervals down to the bottom of the crop's major root zone (soil auger).

(*d*) When rain falls, how much actually fell on the crop (which need not necessarily be the amount which fell a mile away at the home).

Safflower Trials Favour Gila Variety

By G. H. ALLEN, Senior Agronomist.

Safflower is an oil seed crop of potential value to Queensland agriculture. Preliminary studies indicate that the Gila variety may assist this relatively new industry.

A considerable quantity of safflower oil is used annually in Australia. With the exception of relatively small production, emanating principally from Queensland, the demand is met by imports.

In 1953, the Department of Agriculture and Stock in co-operation with C.S.I.R.O. commenced trials at various centres to determine the agricultural requirements and most suitable varieties of Safflower, bearing in mind the grain yield and the oil content of the seed.

A variety 23–1 which came from Nebraska and previously from Egypt was selected by the late Dr. Horowitz of C.S.I.R.O. after repeated trial. It was later named Horowitz. Pure seed was grown and distributed from the Regional Experiment Stations at Biloela and Hermitage.

TABLE 1

Development of Safflower in Queensland

Year	Area grown	Production (40 lb./bus.)
1955–56 ..	4 acres	44 bushels
1956–57 ..	928 acres	11,914 bushels
1957–58 ..	1,957 acres	22,253 bushels
1958–59 ..	7,736 acres	92,021 bushels
1959–60 ..	10,519 acres	108,575 bushels

(Data from Commonwealth Bureau of Census and Statistics.)

In recent years research work has been centred at the Biloela Regional Experiment Station and some 80 varieties, strains and selections have been examined for yield and oil values.

Generally the material has not given any marked improvement on Horowitz although some selections have more favourable oil values and some with a percentage of hull-less seed are of special interest. Hull-less or naked seed would lower costs of transport and simplify oil extraction processes.

One of the introduced varieties, Gila, proved to be approximately 3 weeks earlier than Horowitz, and the shorter, evenly branched plant type is more suitable for machine harvesting and is less subject to lodging.

In a recent yield trial, Gila produced at the rate of 36·5 bus. per acre whereas the yields from Horowitz and a selection were 30·3 bus. and 27·7 bus. per acre respectively.

At present Horowitz is the principal variety grown, although a related strain 23–3–5, which is a slow maturing, smooth-leafed variety with yellow flowers, has some commercial significance. The spiny white-flowered variety 4–1 of Egyptian origin is of minor importance.

None of these varieties is comparable in oil values with leading strains and hybrids now in use overseas, but Gila may offer some improvement.

At ruling prices of up to £45 per long ton at ports, varieties which give reliable yields and high oil content are necessary to compete with alternative crops.

Although material is being obtained from overseas, and work is continuing with available varieties, the promising variety Gila will be further tested in the coming season and seed stocks will be increased to allow a general assessment of its potentialities in the main safflower districts of the State.

Plate 1

The New Safflower Variety, Gila (in middle), is Shorter than the Horowitz Types on Each Side. Gila is evenly and well branched. It yields well and matures earlier than others available.

* * *

Field Days are your Business

Farming today is a tough, competitive business, and the farmer who applies business methods on his farm stands the best chance of success. One of the first principles is to keep yourself informed on the latest trends in your industry.

All over the land, teams of scientists are probing the secrets of nature to help you raise productivity and reduce costs. A great deal of this information is passed on to you through this Journal, in leaflets, newspapers and radio talks. But there's nothing like seeing for yourself. On-the-spot observation of some new method can convey a clearer picture than hours of reading.

That's why the Agriculture Department conducts or helps producer organisations to conduct field days dealing with all types of land activity. The whole aim of these field days is to show you new methods and to explain their merits.

To be successful you have to keep up with the times. Attendance at field days adds to your knowledge and can help you to become more successful. Field days are your business.

—*A. E. FISHER, Agricultural Journalist.*

Hints for the Sheep Station Jackeroo

By M. N. S. JACKSON, Senior Adviser in Sheep and Wool.

For the young jackeroo fresh from school, without any bush experience, or the youth who is seeking experience with sheep on his parent's or other properties during his school holidays, these notes will provide some helpful information.

The ultimate objective of a jackeroo is to become an overseer and manager in turn, while for some the opportunity to become an owner will one day present itself. First and foremost, the prospective jackeroo must have a genuine interest in all animals. Without that interest he cannot expect to be other than mediocre.

Today is an era of specialists and it is not always necessary to attend a university to become a specialist in your own line of business, in this case a station manager. But the prospective jackeroo should see to it that the effort he puts into his training is nothing but the best.

Observation Pays

First and foremost, the jackeroo must train himself to be observant so that he misses nothing during the time he is performing his daily chores. This he is unable to do unless he is interested in his job. If uninterested he passes over things seen without noting them or attempting to find their solution in relation to the stock in a particular area.

Many signs emanating from paddock sheep show the careful observer whether they are happy or not with conditions as they exist in their paddock, and one of the jackeroo's roles is to see and understand these signs. It is important to sheep that they are contented with conditions of feed and water in the paddock allotted them. This contentment will mean that they are likely to make the best use of the conditions available to them by producing a maximum of wool, mutton or lambs, as the case may be.

The art of observing, remembering, and finding a meaning for the multitude of phenomena which are there to be seen and heard, and which have so much bearing on the activities of the sheep owner or manager, can only become a habit by self-training. Physical action is important here; doing is knowing, and doing is remembering.

Perhaps there is a broken wire in a fence, or a strange noise is heard when the windmill and pump is being inspected. If the observer makes a habit on all these occasions of dismounting, or stopping to make a temporary repair by pulling up the wire, or locating and adjusting if possible the unfamiliar noise heard at the watering point, he will be taking his first lesson in the art of remembering.

Strange noises coming from a windmill and pump could mean a loose bolt or something which can be attended to on the spot. But, on the other hand, should the matter be more serious, the mill should be turned off and the boss advised as soon as possible.

In order to recognise that all is not well with the mill and pump, the jackeroo should make himself familiar with its smooth workings.

At all visits to a pumping plant, note carefully the storage tank water level; are the watering troughs and floats in good order? And if the windmill is pumping a full pipe or not. Your boss will no doubt appreciate this information being given to him voluntarily, rather than by questioning.

Observe and memorise all that you see as you ride through a paddock. Such things as the condition of the paddock sheep, condition of pastures and water, and in fact, all that is happening in that paddock which concerns the sheep and improvements.

Signs of discontent shown by paddock sheep are obvious to the trained sheepman but are passed over by the uninitiated.

If the observation of these phenomena becomes a habit, the jackeroo will return to the homestead at the end of the day with all the answers to queries made by the boss.

Signs Tell Stories

The young man who is out for experience should study these signs carefully:

(1) *Sheep pads* which are well worn and follow a line of fencing, but which do not lead

Plate 1

Learn by Doing. One of the best ways of learning and remembering things on a sheep station is to try your hand at doing them.

to a paddock watering place, are a sure sign that the sheep are discontented and would like to go through that fence.

(2) *Sheep grouped together* in a corner of the paddock, or alongside a gateway, often provide another sign that all is not well from the animals' point of view.

Often they show signs of hollowness for want of feed or water.

It is a well-known fact that sheep prefer to feed into the wind, and will do so until halted by the boundary fence, where they will camp. These sheep should not be confused with the discontented ones previously mentioned who will show signs of having camped there for some time.

Whilst on the subject of sheep feeding into the wind, it is as well to have this in mind when mustering a paddock so that their preference to have the wind in their faces, when on the move, can be used to advantage. It can make the difference between a clean muster and one that is not so clean.

Naturally there are occasions when it becomes necessary to move stock into a paddock which is not so good as the one they were in. This probably is unavoidable, and the sheep will soon show their disapproval by hanging in corners, about the gates and on fences. In all cases of this nature, the animals should be quietly driven out into the paddock away from the fences. If this is done regularly, the sheep should settle down after a few days.

(3) *A sunken or hollow appearance* is generally a sign that the sheep are not going to water to drink as often as they should. Some of them may not be familiar with the way to their drinking point. The remedy for this is, of course, obvious; when you put sheep into a new paddock, make sure you take them to the water.

(4) *Sheep of the Merino breed prefer to graze collectively* in fairly big mobs, so that if found to be grazing in small groups it is not unlikely that the pastures are insufficient.

The sheep of today has been by means of selection, developed into an animal which will produce a maximum of wool and meat in a minimum of time. It prefers to take life easily, and when full and contented, spends the greater part of its time lying down resting or sleeping.

It prefers to feed after sunrise for a few hours, camp during the greater part of the mid-morning and afternoon, and feed again late in the afternoon until dark.

During the hot weather in western Queensland, sheep may spend most of the day sleeping in the shade and feed during the early part of the night. When, therefore they are found moving about the paddock in their efforts to feed during the heat of the day, it shows that the feed is scanty and the animals are taking longer to fill themselves.

(5) *Sheep droppings* are usually a good sign as to whether the animals are thriving or not. Normally these will fall in separate oval pellets which are either hard or soft according to whether the feed is dry or green. Dry feed will produce the hard pellets, and sappy green feed will produce soft. When the feed is particularly soft and luscious the pellets are grouped together in masses and do not fall separately. Under these conditions, which will be noticed on the animals' camping grounds, it can generally be taken for granted that the animals are thriving.

There are many signs of content and distress shown by paddock sheep that will be understood by the trained bushman.

The ability to detect and diagnose these signs can only be acquired by observation and practice. Having detected and diagnosed, the good sheepman will immediately concern himself with finding the remedy.

In times of feed scarcity, a jackeroo may be asked by his boss to ride through a paddock and let him know how the feed is holding.

He should be on his guard here, and beware of an impression based solely on a ride through the paddock either early in the morning, when riding out from the homestead, or late in the afternoon, when riding home, as both impressions could be quite false. At these times the sun's rays are low and slanting, bringing into relief the individual blades of grass to such an extent that the new grass appears to be much more abundant than is really the case. Because of this, an impression gained at midday or thereabouts will be much more reliable.

Plate 2

Interest in Stock. A man who intends to spend all his life with stock should learn all he can about them. He can do this successfully only if he is genuinely interested in the animals.

When making an estimate of the available paddock feed, an observant jackeroo will take particular notice of all shrubs and bushes which show signs of having been eaten by the sheep.

Usually these are eaten only when the pastures are in short supply, except perhaps when the bushes or shrubs are some of those to which the animals are often very partial. Normally a sheep will prefer to graze the pasture until its supply is approaching exhaustion. Should the shrubs and plants be well eaten back it is likely that the paddock is becoming overstocked because of the pasture being in short supply.

To sum up, a jackeroo should train himself to be:

(1) *Interested in,* and fond of, all animals. Unless a jackeroo has this interest he may as well take on some other job. Without this interest, whether it be in animals or other types of work, we cannot bring out the best that is in us.

(2) *Observant,* so that he not only sees "all" but understands "all" he sees, or makes it one of his hobbies to find out "why."

(3) *Busy.*—Make it obvious to your bosses that you are not one of the drones, but in the market to learn all you can about everything that is done on the property.

Remember that, although it may not be your job, you should know how to do anything that you might have cause to ask others to do at a later date, when you have graduated to the rank of "Boss".

(4) *Honest about Mistakes.*—Do not mind owning up to your mistakes; it is only human to

err, and we have *all* made a "blue" at sometime during our lifetimes. Therefore, admit your error and do it the correct way next time.

(5) *Careful about Watering Points.*—Do not at any time ride or drive past a watering point without stopping and checking that all is well with the supply and plant. It may be an open earth tank or, on the other hand, it may be fitted with a pumping plant and troughing.

(6) *Attentive to Horses.*—Spare your saddle horse all you can; he will often be required to carry you long distances, often under conditions which are not the best.

Remember, at all times, that it is hotter on the ground where your horse is than it is on his back where you are. Examine your horse's back and girth area at all times when removing the saddle so that any signs of rubbing and girth galls can be attended to without delay. A little time spent with soft soap and oil on saddle flaps and girths, as well as rinsing the horse sweat regularly out of the saddle cloths, will keep sore backs and girth galls to a minimum.

Your horse will appreciate these little attentions to the saddle as much as if you brush him down before saddling up and also washing his back with cool water before letting him go in the paddock at the conclusion of the day's work.

(7) *Steady with Stock.*—Do not at any time overdrive sheep. Like all other animals, they are closer to the heat of the ground than is the horseman sitting on top of his horse, and for this reason are easily over-heated.

Allow more time than you think necessary to carry out a job which requires sheep to be driven. The extra time allowed will often be taken up by unforeseen delays, whilst on the other hand should these delays not occur and you arrive early at your destination, there is no harm done.

How often do we see sheep over-driven so that the musterers are able to put their feet under the dinner table right on time! The remedy for this is obviously a cut lunch, even if it becomes necessary to eat it within sight of the homestead, whilst the sheep are camping.

(8) *Cheerful.*—Accept cheerfully every job that you are given, even though you don't like the job, and in your humble opinion, fail to see its necessity. After all, someone thinks the job worth while so that there must be one good reason to justify it.

(9) *Friendly.*—Be friendly with all those you come into contact with. The value of their friendship will some day be brought home to you when perhaps you are looking for a job on completion of your apprenticeship.

(10) *Studious.*—A jackeroo, has a very full day. Nevertheless, in the evenings, and perhaps during a week-end here and there, when there is a lull in social activities, there will be hours of inactivity. This time can always be spent very profitably in study whether it be animal husbandry, wool classing, or book-keeping. These subjects will stand any bushman in good stead. They can be studied and completed by correspondence with, in most cases, an issue of a diploma at the end of a successful pass.

New Book on Tobacco Growing

All Queensland tobacco growers may now obtain free of cost an up-to-date book on tobacco growing in Queensland.

This book contains four main sections prepared by various specialist authors. The first section covers the growing of the crop, curing and preparation for market, while the others cover diseases and their control, pests and their control, marketing and customs and excise regulations.

The book is well illustrated, several pages of colour photographs being included in addition to the usual black and white illustrations.

To obtain this book free of cost it is only necessary for a tobacco grower anywhere in Queensland to register with the Department of Agriculture and Stock. This registration is normally required each year under the regulations of the Tobacco Industry Protection Act, and forms can be obtained from Departmental officers in all tobacco growing areas, or from the Department of Agriculture and Stock, William Street, Brisbane.

Tuberculosis-Free Cattle Herds

(As at 1st May, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Angel, W. D., "Summerhill", Murgon
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Citrus Diseases In Queensland—2

By B. L. OXENHAM, Senior Pathologist.

The second part of this three-part article deals with virus diseases of citrus.

The virus disease psorosis has been well known in Queensland for many years. It is only in the last decade or so, however, that scientists and orchardists have become fully aware of several other viruses affecting citrus trees. The symptoms of some of these conditions had been under observation for a long time but the cause had escaped detection. The recent expansion in plant virus research throughout the world has now enabled many of these diseases to be clarified.

Virus diseases are not always spectacular in their effects on the host trees but may instead cause a slow decline and reduction in productivity. Tree crops are expensive to bring into production and are by their nature intended for long term farming. It is therefore important to control virus diseases and by so doing help to prolong the fruitful life of the trees.

The following is a key to assist in the diagnosis of citrus virus diseases:

1. Pitting and grooving of the wood of grapefruit trees; tree stunted, fruit small and lopsided	**Stem pitting.**
2. Scaling of the bark on trunk or limbs; often starting as chains of pustules	**Psorosis.**
3. Stunting of trees on trifoliata stock with scaling of bark below bud union	**Scaly Butt.**
4. General decline of mandarin trees on rough lemon rootstock	**Mandarin Decline.**
5. Cracking and shelling of areas of bark on trunk or main limbs of lemons	**Shellbark.**
6. Rapid collapse or else chronic decline of trees on sour orange or grapefruit stocks	**Tristeza.**

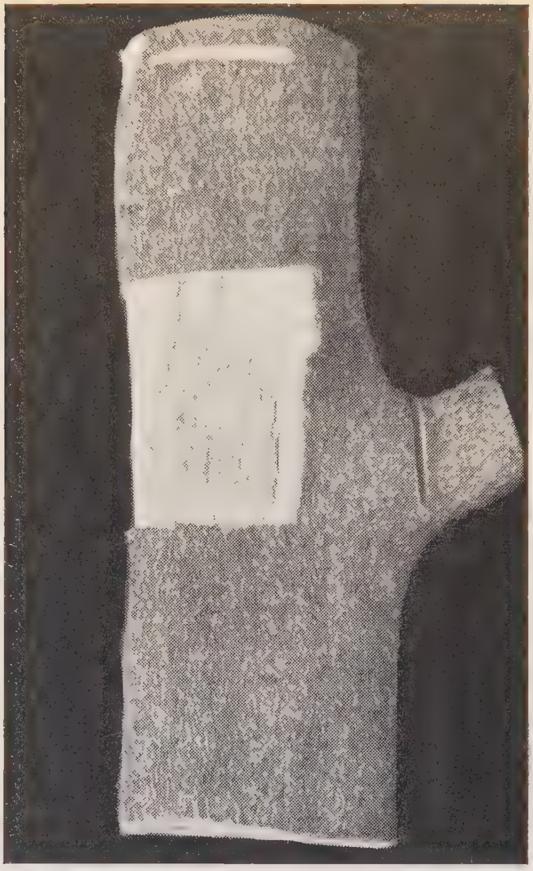

Plate 1: **Grapefruit Stem Pitting; with Bark Removed to Expose the Affected Wood.**

Stem Pitting of Grapefruit

Stem pitting virus disease is restricted in Queensland to grapefruit, and in particular to the Marsh grapefruit, which is the main commercial variety.

This virus causes a pitting and grooving of the surface of the wood (Plate 1) and projections from the bark fit into these cavities. The damage is most easily seen when the bark is removed

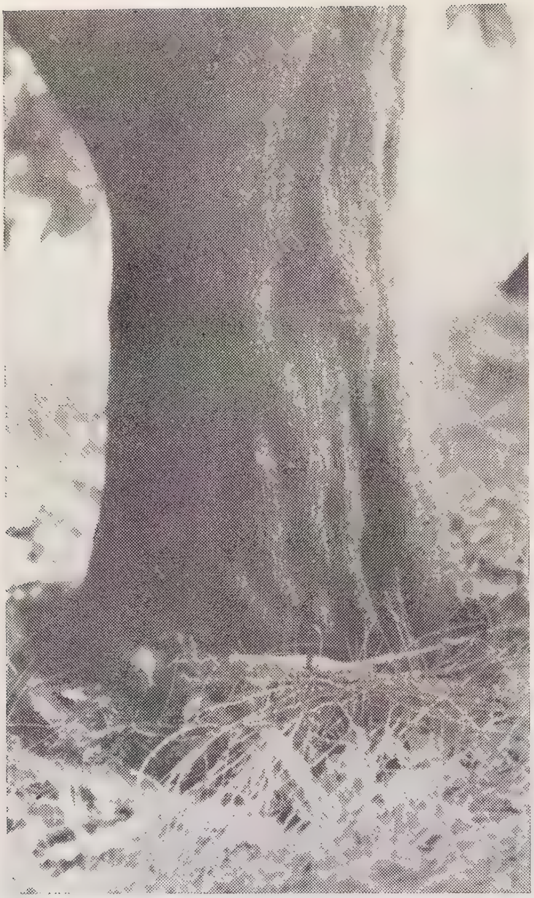

Plate 2

Stem Pitting on Trunk of Grapefruit Tree.

from diseased areas. Trees affected for some time show a dimpling of the trunk and larger limbs (Plate 2). These dimples may be 2 in. or more in diameter and are quite obvious. In severe cases the whole trunk is distorted.

Infested trees are reduced in growth and become bushy in appearance. They produce small fruit which are often lopsided. A yellow mottling of the young leaves is often observed during growth flushes. Occasional trees decline rapidly and may collapse completely within a year.

The casual virus is spread by the use of diseased buds in propagation and also very readily by the common black citrus aphid. All the popular varieties of grapefruit are susceptible to stem pitting and the disease develops irrespective of the rootstock used. Most of our citrus trees are thought to be carrying the virus although only grapefruit show obvious effects. Consequently it is pointless to propagate virus-free grapefruit as they are quickly infected by means of the citrus aphid.

In New South Wales, and latterly in Queensland, trees have been selected which carry mild strains of the virus. These mild strains do not seriously effect the trees and it is hoped will protect them from infection by more severe virus strains. Although the use of budwood from such trees is associated with some element of risk no other remedy is at present available.

Grapefruit trees infected with stem pitting may be successfully top worked to other tolerant varieties. This practice has been carried out with good results in a number of orchards.

Psorosis

Psorosis is sometimes called "scaly bark" and has been known in Queensland for over 30 years. Symptoms are rarely seen before the trees reach 10 to 15 years and have been noted in odd trees of most orange and mandarin varieties.

The most obvious symptom is the scaling of patches of bark on the trunk and main limbs. This scaling differs from the longitudinal bark cracking and peeling caused by white louse damage and other injuries. With psorosis the bark lifts in irregular flaps which remain attached for a time in the centre or on one side. Preceding this severe scaling, there are patches of blisters or pustules over which the bark lifts in small caps (Plate 3). Chains of these pustules may extend up the limbs.

If the scaling girdles the trunk or main limbs the tree is rapidly affected as the wood dies under the lesions. If only odd scaly patches are present an affected tree may survive for a long period.

Another more virulent form of psorosis is sometimes seen. The pustules are deeper and bark lifting is preceded by gumming. Effects on the vigour of affected trees are also more drastic.

Leaf symptoms may occur with both forms of psorosis. The patterns produced are transient, however, and usually not obvious unless a search is made at the appropriate stage of growth.

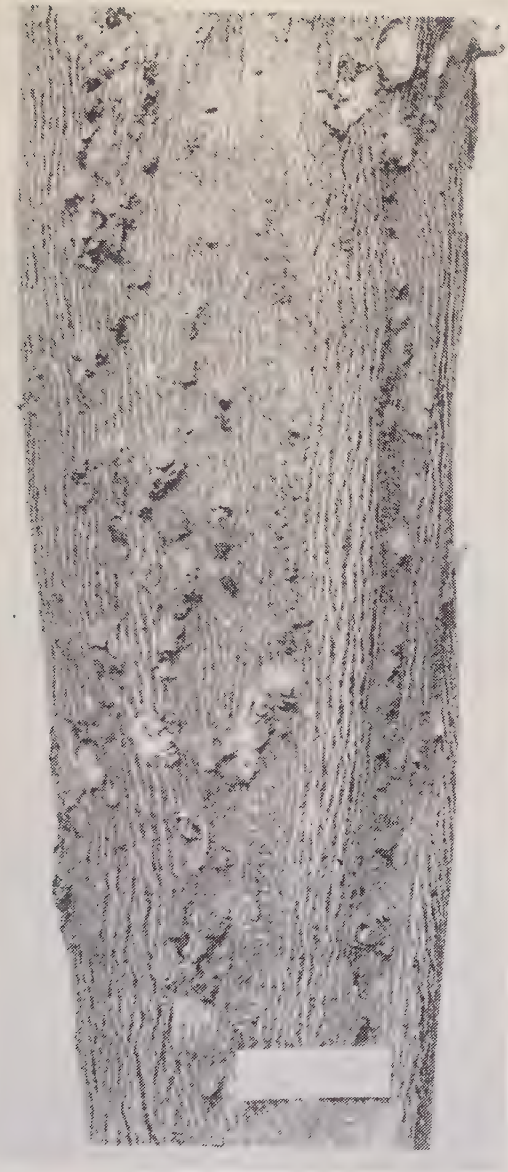

Plate 3

Psorosis on a Mandarin Limb.

A condition known as "crinkly leaf" of lemons is also attributed to a strain of psorosis. The leaves on affected trees are flecked, puckered and crinkled and some of the fruit is distorted. This disease is uncommon in Queensland lemons.

An insect vector or carrier of psorosis has not been located and seed transmission is unknown. Buds supplied to nurserymen through the Citrus Budwood Scheme are taken from mature trees showing no symptoms of psorosis. Consequently, although psorosis may be observed in some orchards of aged trees it is uncommon in trees that have been propagated during the operation of the budwood scheme.

Infected trees cannot be cured but their life may be prolonged by pruning out badly affected limbs, scraping away the diseased bark from newly affected areas and painting the scars with a copper paste to prevent fungal infection.

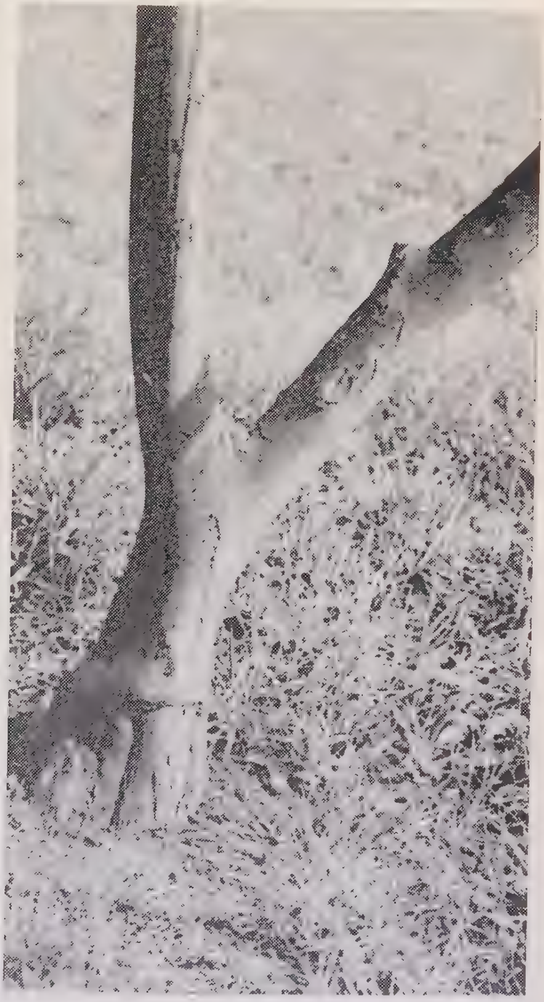

Plate 4

Scaly Butt; Villa Franca Lemon on Trifoliata Stock.

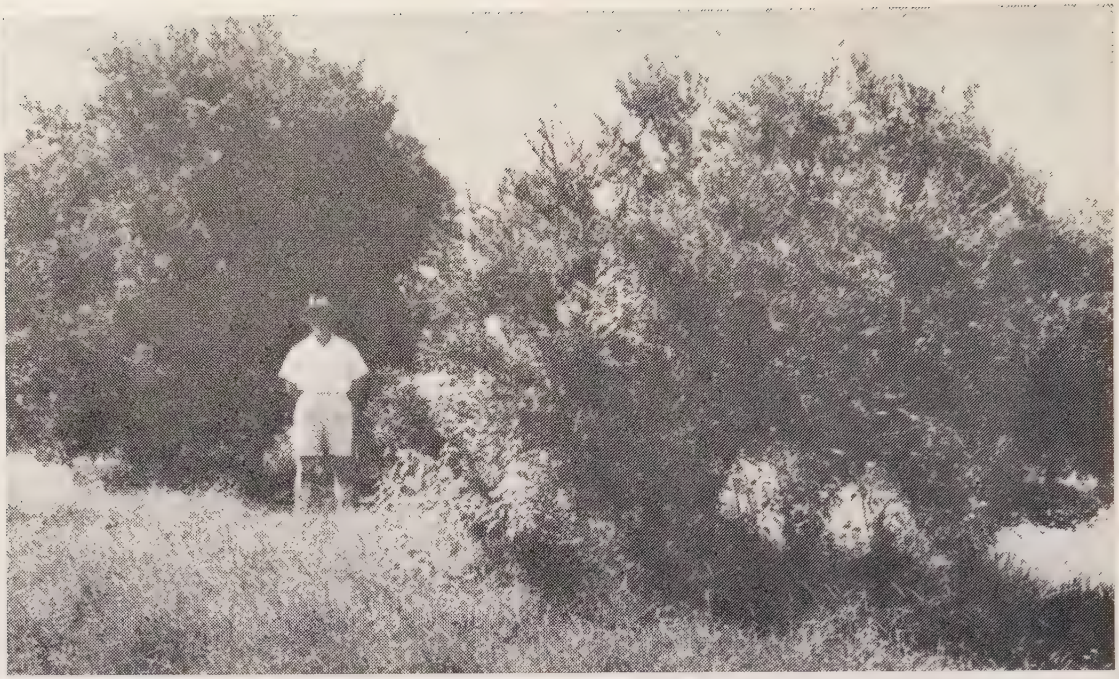

Plate 5

Mandarin Decline. Decline symptoms apparent in Ellendale mandarin tree on rough lemon stock, healthy Ellendale tree of same age on sweet orange in background.

Scaly Butt of Trifoliata

Scaly butt, often called exocortis in overseas literature, affects trees worked on trifoliata or some trifoliata hybrid rootstocks. Trifoliata stocks have been used to some extent in the last 10 years in Queensland and scaly butt has come into evidence.

Affected trees are severely stunted and the rootstock is reduced in size instead of being large and fluted. There is a variable amount of bark scaling below the bud union, the bark on the stock cracking and peeling off in strips (Plate 4). Symptoms usually become obvious when the affected trees are 4 to 8 years of age and although they continue to bear fruit the dwarf size of the trees makes them most unprofitable.

Scaly butt is spread by the use of buds taken from virus infected trees. The position is complicated by the fact that trees on other rootstocks such as sweet orange or rough lemon may carry the virus without showing detectable symptoms. It is therefore most important when selecting budwood for working onto trifoliata that only buds from healthy, mature trees already on that rootstock are taken. Spread of the disease by insects or through seed has not been demonstrated.

Mandarin Decline

A slow decline of Ellendale Beauty mandarins growing on rough lemon stock has been shown in Victoria to be due to a virus disease. A similar condition occurs in this variety and also in Beauty of Glen Retreat mandarins in Queensland.

The infected trees make fairly normal early growth but after a few years are reduced in vigour and take on a squat appearance because of their sparse, short twig growth. A yellowing of the leaves, particularly in the veins, is common, and the leaf tips are often curled downwards. Cropping is reduced and the fruit tend to have a coarse rind.

Such symptoms as these may also be caused by other factors and therefore the decline is most obvious when Ellendales on rough lemon are growing near similar trees on a tolerant rootstock such as sweet orange (Plate 5).

The decline virus is spread by the black citrus aphid as well as by the use of infected buds in propagation.

The remedy lies in the planting of Ellendale and Glen mandarins on a sweet orange or mandarin rootstock and *not* on rough lemon.

Shellbark of Lemons

Shellbark disease is almost universal in Villa Franca, Lisbon and Eureka lemons in Queensland. It is thought to be caused by a virus which damages the inner bark, allowing fungal infections to develop. The combined effect results in the shelling of the bark on the trunk and main limbs.

Shelling commences as a cracking of the bark with a variable amount of gumming. The outer bark then dies and peels off in strips (Plate 6). The inner bark remains alive and replaces the damaged outer layers. When healing is complete it may be months or years before symptoms recur. Affected trees often receive a check in growth prior to and during a bout of shelling, but then return to normal vigour when the healing processes take over.

Under Queensland conditions, lemon trees may first show symptoms of shellbark when they are under 5 years of age. The shelling is often quite extensive and may involve most of the trunk as well as the lower parts of the main limbs. In humid coastal districts, severe fungal infections following shellbark attack may cause considerable damage. In drier areas, however, trees which have shown symptoms of shellbark for over 20 years are still producing profitable crops without any serious decline.

It is not advisable to treat affected trees as would be done with psorosis or collar rots. Scraping and painting of the diseased areas damages the underlying tissues and hinders healing. Heavy pruning, which is the normal practice with lemons in Queensland, appears to aid recovery.

The nature of the spread of shellbark is still in doubt but it is known that some lines of trees of nucellar origin are less affected than the older varieties. The Horticulture Branch of the Department of Agriculture and Stock has propagated nucellar lines of the main lemon varieties grown in Queensland. If these show promise they may eventually replace the older budwood lines.

Tristeza or Quick Decline

The disease known as tristeza or quick decline has not been important in Queensland because intolerant rootstocks such as sour orange or grapefruit have rarely been used here. In countries where these rootstocks were popular, however, the spread of tristeza has been accompanied by devastating damage.

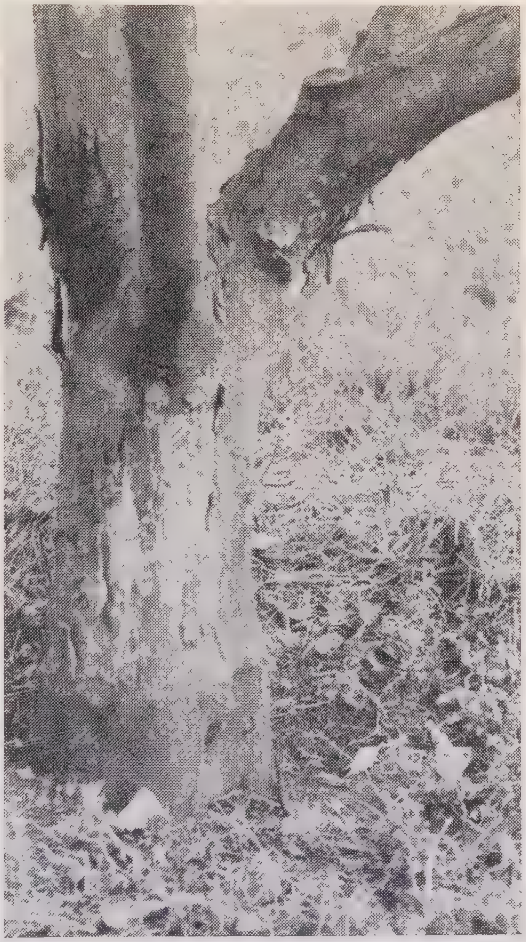

Plate 6

Shellbark on Eureka lemon tree.

Tristeza virus is widespread in Queensland but causes no obvious damage in trees worked on tolerant rootstocks such as rough lemon, sweet orange or mandarin. Black citrus aphids readily spread the disease from these symptomless carriers.

Symptoms of tristeza largely resemble those resulting from ringbarking as the disease causes a blocking of the food-conducting tissues at the bud union. In acute cases the trees wilt and collapse rapidly, whereas in chronic cases they are stunted and unthrifty and exhibit various symptoms of starvation.

As the virus and its aphid vector are so common in this State it is essential that orchardists plant their trees on tolerant rootstocks. The stocks such as rough lemon, sweet orange, mandarin and trifoliata normally used by nurserymen are all tolerant. Growers who contemplate working trees on unusual rootstocks should first obtain advice on their virus tolerance.

SUMMARY OF CITRUS VIRUS DISEASES

Virus	Main Variety or Rootstock Affected	Method of Transmission	Control
Stem Pitting	Grapefiruit scions ..	Buds and aphids	Budwood containing Mild Virus Strain
Psorosis ..	Orange and Mandarin scions	Buds ..	Virus free budwood
Scaly Butt	Trifoliata Stock ..	Buds ..	Virus free budwood
Mandarin Decline	Mandarins on R. Lemon stock	Buds and aphids	Orange or Mandarin stocks
Shellbark	Lemon scions ..	Buds ..	Virus free or resistant budwood
Tristeza ..	Various varieties on Sour orange or Grapefruit stocks	Buds and aphids	Rough lemon, Sweet Orange, Mandarin or Trifoliata stocks

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Fast-Milking Herd Is The Aim

By A. J. W. MURRAY, Senior Dairy Adviser.

Every dairyfarmer should aim at having a fast-milking herd to obtain the maximum quantity of milk with the minimum of effort. To shorten the milking time of the herd, two remedies are possible: cull slow-milking cows which waste time, and train cows to "let-down" milk effectively. Also to milk cows as quickly as possible your milking machine should be kept in good condition and operated as recommended.

It is well known that milking is performed much more quickly and with less physical effort on some farms than on others. Milking on these properties is not twice-a-day drudgery because precautions are taken to see that milking proceeds smoothly, and quickly. If less time is needed for milking, more time can be spent on other jobs on the farm.

Milking Investigations

To determine those conditions of milking and milking practices which will speed up milking, it is necessary to carry out controlled experiments on cows. Such information cannot be obtained by casual observation of milking procedures. Investigations into milking methods in Queensland are now being made with a recently developed scientific electrical milking meter, which records the milk flow rate of cows. From the graphs drawn by this apparatus, the time taken to milk, the rate of milking, and the quantity of milk can be easily obtained. During 1958-1959, milking trials were done in North Queensland on the property of a Malanda farmer, Mr. J. F. Evans, who made his A.I.S. stud herd available for investigations.

Further trials in 1960 have been made with the co-operation of Ipswich district farmers, Messrs. O'Neill Bros., of Peak Crossing.

Effect of Vacuum Conditions

Milking cannot be carried out efficiently if the milking vacuum is not adjusted correctly. Do you know how milking is affected if the vacuum is altered? The trials in north Queensland were designed to give this information.

Milking was done at vacuum levels ranging from 10 to 16 in. using teat cups with plain inflations. It was found that lowering the vacuum in this range reduced the rate of milking so that a longer time was required to obtain the same amount of milk. The averaged results showed that a cow which gave 15 lb. of milk in 4 min. at 16 in. vacuum would take about 5 min. to milk at 12 in., and over 5½ min. at the 10 in. level. This minute or more saved on each cow at the higher levels amounts to a considerable length of time over the whole herd.

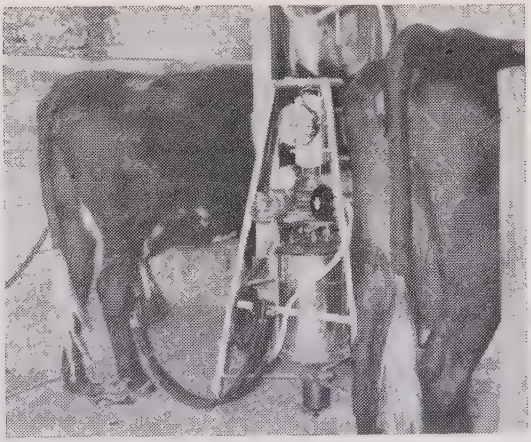


Plate 1

The Weighing and Signalling Apparatus in Operation in the Bails.

Plate 2

The Electrically Operated Recording Meter on which Milk Flow Patterns Are Traced. The drum revolves during milking operations and progressive milk increases of 0.2 lb. are noted.

So, to ensure that cows are milked out as quickly as possible, keep the vacuum of the plant at the 15 in. level.

While cows can be milked satisfactorily with lower vacuum conditions, in addition to the extra time taken, teat cups tend to fall off the cows because of a lack of air reserve. Milking at 15 in. is recommended with all types of soft plain inflations. A lower vacuum of 13 in. is recommended by the manufacturers of a moulded type inflation.

Consideration must also be given to other points in milking machine operation. Adequate air-reserve must be maintained in the plant so that the vacuum will remain stable. This prevents large fluctuations in the vacuum level when cups are taken off in one or two bails.

The relief valve and vacuum gauge are important parts of your milking machine. Keep the relief valve clean, so that it can regulate the vacuum accurately, and be sure you know what is the true vacuum reading of the gauge.

Pulsation ratios (ratio of "squeeze" to "release") will also affect the time it takes to milk the herd. Always take care to see that the teat cup inflations are kept at the correct tension, so that the full benefit of the pulsation action will be obtained. Slack inflations will not maintain the necessary squeeze/release ratio and thus will not milk cows properly.

Defects in the operation of your milking plant must be corrected to obtain the benefits of quicker milking. Faults in milking machines are readily detected and generally cost comparatively little to put right. All dairy officers in Queensland are trained to check milking machines, and this service is free for the asking.

Teat Cup Vacuum. It is known vacuum conditions inside the inflation change in sympathy with the pulsating vacuum in the teat cup shell. Measurements were made on the way in which this vacuum level inside the inflations changed as milking progressed. It was found that as milk was flowing freely from the teats through the inflation up into the milk line, the average vacuum level during the squeeze/release cycle was lower than when only a small amount of milk was flowing. Only when the milk flow becomes very low does the vacuum at the teat cups become nearly equal to that in the line. There was very little difference in the teat cup vacuum during the period of fastest milking, at 12, 14 or 16 in. of line vacuum. Therefore, while milk is flowing there is no danger of damage to the teat linings or udder tissues at any of these vacuum levels. However, when the milk flow ceases it is important. The vacuum at the teat then becomes equal to that in the line and, unless the cups are removed promptly damage to the teats and udder can occur and may result in inflamation and mastitis infection.

Machine Stripping

In these trials, cows were machine stripped. There was no difference in the amount of machine strippings, or in the time taken to strip in the range of 10 in. to 16 in. milk line vacuum. There was also no evidence of teat cup crawl with the cows used in these tests, even at the 16 in. level.

Most cows can be trained to machine-stripping. The cows used in these investigations were hand-stripped before the trials and, with no prior training, were machine-stripped by the milking operator who was a stranger to the herd at the start of the investigations. To ensure that

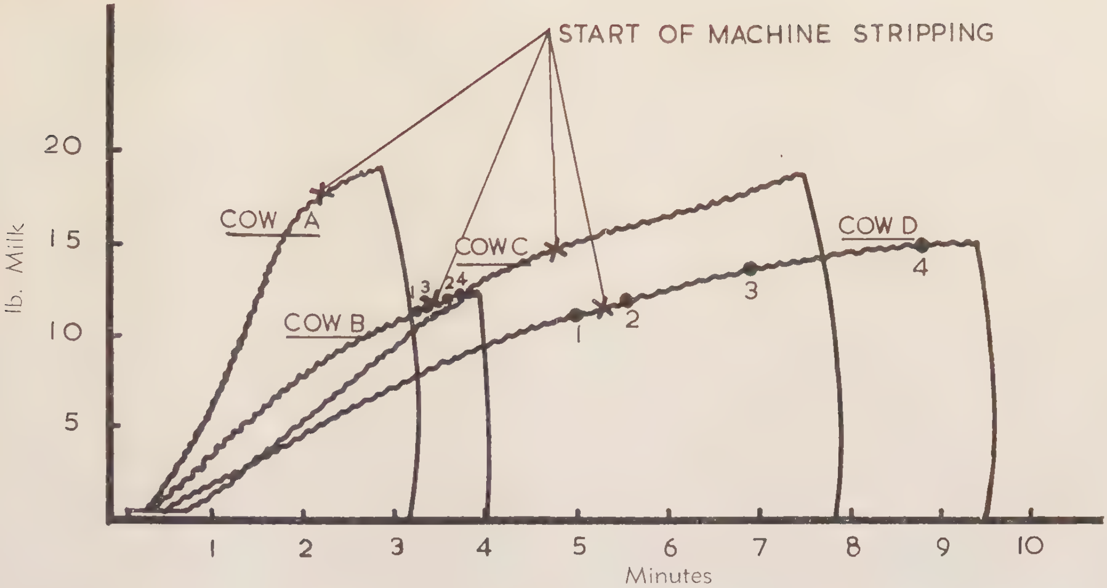


Plate 3

Graph Showing Yield and Milking Time.

machine-stripping was effective, each quarter was checked by hand when the cups were removed. The amount of milk obtained by hand from each cow was never more than 0·2 lb. Machine-stripping is cleaner, quicker, and more efficient than hand-stripping, but it must be done correctly. Use both hands, one bearing down on the teat cups, the other massaging the udder. When you feel the udder is empty, the cups must be removed promptly.

Cows are individuals, and for successful milking an understanding of the milking pattern of each cow in the herd is essential. All quarters of a cow do not always milk out at the same time. Some teats stop milking 1 or 2 min. before the last teat is milked out. A time lapse of 4 min. between cessation of milk flow in the first and last quarters has been recorded in a slow milking cow.

Milking patterns of four cows are illustrated in Plate 3 and two curves show at what stages the four teats ceased milking.

Feel the udders occasionally during milking, and commence machine-stripping when the first quarter becomes slack. If this is not started until the milk flow has ceased showing in the sight glass, injury could be caused to the linings of the teats and quarters which first stopped milking.

Variations in milking rates

What part do the cows themselves play in the time it takes to do the milking? Not many of us have bothered to take notice whether "Pansy" milks out quicker than "Petal", or if a particular family of cows are slow milkers.

The importance of selecting cows because of their milking habits was demonstrated in these trials. Very large differences were observed between the milking rates of the individual cows recorded. While some cows gave an average of 4½ to 5 lb. of milk per min. others gave only 1 to 2 lb. per min. under the same milking conditions. Cow A milked at a rate of 6·1 lb. per min. while cow C milked at a rate of 2·2 lb. per min. This means that the faster milking cow was milking out in 3 min. while a slow milking cow took 6 or 7 min. to give the same amount of milk. Recordings made of cow D show it took over 9 min. to give 14 lb. of milk (Plate 3).

When cows are milked under constant milking machine conditions and using the same milking methods, so that all cows receive the same treatment, the only variables that will affect milk flow are the milking characteristics of the individual cow. This individuality is related to such factors as the structure of the teat canal and sphincter muscle and the speed at which let-down hormones are carried to the udder. Even most favourable milking methods or the most efficient milking machine will not make the milking rate of normally slow cows similar to that of the fast milking cows.

How can a farmer know his slow milking cows? The time between placing the cups on to the teats and the commencement of machine-stripping when the udder becomes slack should be taken as the machine milking time. Additional visual indications of cessation of milk flow can be provided by the use of transparent milk tubes attached to the milking claw, or special teat cups now available which have individual sight bowls attached. Research has shown that the conventional sight glass alone does not give an accurate indication of the time to commence machine-stripping. A much more positive indication of the time for machine-stripping can be obtained by feeling the udder with the hands.

TABLE 1

Cow	Milk Yield Yield (lb.)	Milking Time (Min.)	Maximum Milking Rate (lb./min.)	Average Milking Rate (lb./min.)
1	17·2	2·8	8·0	6·1
2	15·0	4·1	5·6	3·7
3	16·8	7·8	4·0	2·2

An average cow milks at the rate of approximately 3 lb. of milk per min., when milking is carried out efficiently. Cows with rates considerably less than this are slow milkers. A cow giving 25 lb. of milk in 5 min. milks at the fast rate of 5 lb. per min. A cow giving 14 lb. of milk in 7 min. has a slow milking rate of 2 lb. per min. There are many cows in commercial herds which give considerably less than 3 lb. of milk per min. Details in Table 1 relate milking yield, milking time, maximum milking rate and average milking rate for three cows.

Slow-milking cows should be marked as potential culls and replacements selected from them only as a last resort.

Whether a cow is slow or fast milking can be determined by dividing the machine milking time into the total amount of milk given. Assessing the time taken to milk each cow is a simple task, but to work out the milking rate the yield of milk is also needed.

There are only two accurate methods of finding out the milk yields of individual cows. Those farmers who are members of Herd Recording Groups already have this necessary information available to them. To the remaining farmers it is suggested that they either join a Herd Recording Group in their district, or purchase an inexpensive test bucket and set of scales, which will allow each cow's milk to be weighed separately. It is only necessary to check each cow once, preferably about 2 months after calving to obtain an indication of the rate at which milk is withdrawn from the udder.

Hints to speed up your milking routine

The wise farmer knows that it is to his benefit to speed up the milking process as much as possible. Slow milking may mean lower production as well as making milking time unpleasant for both the cows and the milker.

Keep your milking machine in good condition. An inefficient milking machine can cost you time and money. It costs you nothing to have it checked by your dairy officer.

Always observe good cowmanship when handling the herd. Be sure the cows are kept contented by adopting management practices which promote good relationship between the cows and the operators.

Slow-milking cows are a liability in the herd and waste time. When culling, keep in mind the advantage of having a fast-milking herd and cull those cows which are difficult and slow to milk.

A Cow Family Breeding Policy

By F. J. SLATTER, Dairy Adviser.

On many dairy farms in Queensland, dairymen have endeavoured to improve the production of their herds by culling the low producing cows, rearing calves from the higher producers, and selecting bulls from dams with a high production record for one lactation only.

This selection of herd replacements from the higher producing cows in the herd often proved disappointing. Their daughters' production tended to regress to the herd average and in many cases the daughters of lower producing dams proved to be higher yielders.

However, in recent years the emphasis has passed from the individual high producing cow to cow families or strains as suitable breeding stock. In many herds it has been found that cows of certain families have the ability to transmit their high producing ability consistently to their progeny.

In breeding replacement animals, concentration on stock from strains, families and studs that have given evidence of outstanding lifetime quality will mean less chance of failure. It means that the source of breeding material is one that has been shown to be rich in the qualities wanted and the greater the concentration within a family as revealed by consistently high production the better the chance of selecting an animal that will transmit those qualities. In the early stages, some inherent faults may become intensified, and this demands a strict culling programme to ensure that only desirable characteristics are retained in the progeny.

This strictly controlled breeding plan of concentrating on a limited number of cow families has been practised by a number of leading stud owners in this State.

An excellent example in the use of cow families is provided by the Valera A.I.S. stud owned by Messrs. Sullivan Bros., Pittsworth.

Valera A.I.S. Stud

The Valera A.I.S. stud was founded by Sullivan Bros. in the Pittsworth district in 1933. They realised the value of herd recording as the only reliable manner in which to assess and record the production characteristics of a cow, and so they immediately submitted the cows for test. Unfortunately, in those days the general practice was to submit a cow for test and if she qualified for entry into the Advanced Register she was not recorded for any subsequent lactations. Had all the cows been recorded each year a greater wealth of information would have been available and quicker progress would have resulted. From production and breeding records they found that certain cows and their daughters were more consistent breeders and producers that others.

Fed under farm conditions, these cows were a much better proposition, economically, than others in the herds. Although at that time no prominence had been given to cow families in dairy cattle breeding, the Sullivan Bros. decided to concentrate on certain families of cows, and moreover, to select their bulls from the top cows in those families.

In concentrating on cow families, yield was, naturally, their first concern. However, other factors important to stud breeders, such as correct type, good vessels, consistent breeding, temperament, and resistance to common diseases, had to be given serious consideration, and only families which measured up to all requirements were retained.

The plan of breeding cow families has been so well carried out, that, today, only four main families remain in the Valera herd. They are the Roseleaf, Bonnie, Una, and Jean families. As will be seen later, the Bonnie family embraces the Sally and Lila families.

The way in which the herd has been bred to secure these families can be shown through a short history of each family.

Bonnie Family

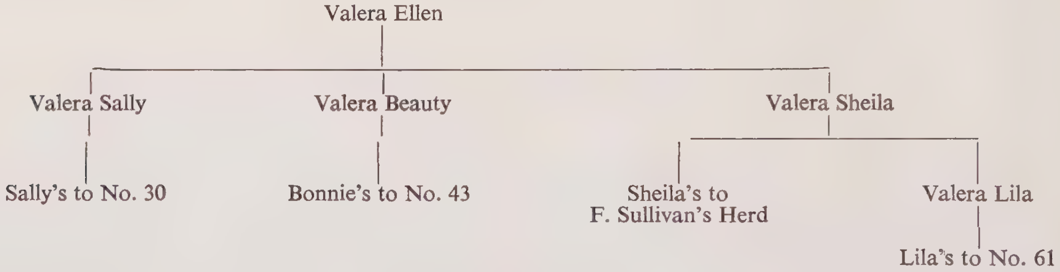
One of the foundation cows in the Sullivan herd was Valera Ellen, and from this cow the Sheila, Bonnie, Sally, and Lila families have descended. Mated with Loyalist of Strathdhee, the first bull used by the Sullivan Bros., Valera Ellen gave full sisters Sheila (847 lb. butterfat in 365 days) and Sally (439 lb. in 273 days) to the Valera herd. Beauty (573 lb. butterfat in 273 days) was another daughter of this cow.

These daughters were named before the importance of family names was realised. As a result, Sheila's first daughter became Valera Lila and Beauty's became Valera Bonnie.

After this, family names were followed. Sally's daughter became Valera Sally 2nd, Sheila's second daughter became Valera Sheila 2nd, Bonnie's daughter Bonnie 2nd, and Lila's daughter became Lila 2nd.

These names have been carried on until, today, they have reached Lila 61st, Bonnie 43rd, Sally 30th.

All the Sheila family were taken by one of the brothers, Mr. F. B. Sullivan, when he founded his own A.I.S. herd. A family tree of the dam side of this family would look like this.



Roseleaf Family

The year 1934 was a dry one in the locality, and the Sullivans purchased 6 aged cows from Mr. Stanley Mitchell of the Rosenthal Stud, Warwick, for £5 a head. Among these cows was Rosenthal Roseleaf 3rd. She was in calf to Rosenthal Carbine and this calf was called Rosenthal Roseleaf 17th. Valera Roseleaf 17th calved twice before she was 2 years 6 months old, and in the two lactations of 273 days, she produced 278 lb. butterfat and 496 lb. butterfat.

The first daughter of Rosenthal Roseleaf 17th became Valera Roseleaf. This family has stood the test of concentrated breeding and has maintained production and type so well that, to date, 85 Roseleaf females have been registered in the A.I.S. Herd Book, all direct descendants of Rosenthal Roseleaf 17th. She proved her longevity by living to the age of 20 years and her breeding ability by producing 17 calves.

Bulls from the Roseleaf family have also been used extensively in the Valera herd. So extensive in fact has been the concentration on this proven family that there is not one animal under 10 years old in the herd today that does not carry an infusion of Roseleaf strain.

Plate 1

A Typical Group of Cows from the Una Line, Bred by Mr. M. Sullivan, of Pittsworth. The cows are Una 12 (grand-dam), Una 42 (daughter) and Una 31 (dam).

Three of the Roseleaf sires that were used at Valera have been sold interstate for artificial insemination work, the latest of these being Valera Roseleaf's Remembrance.

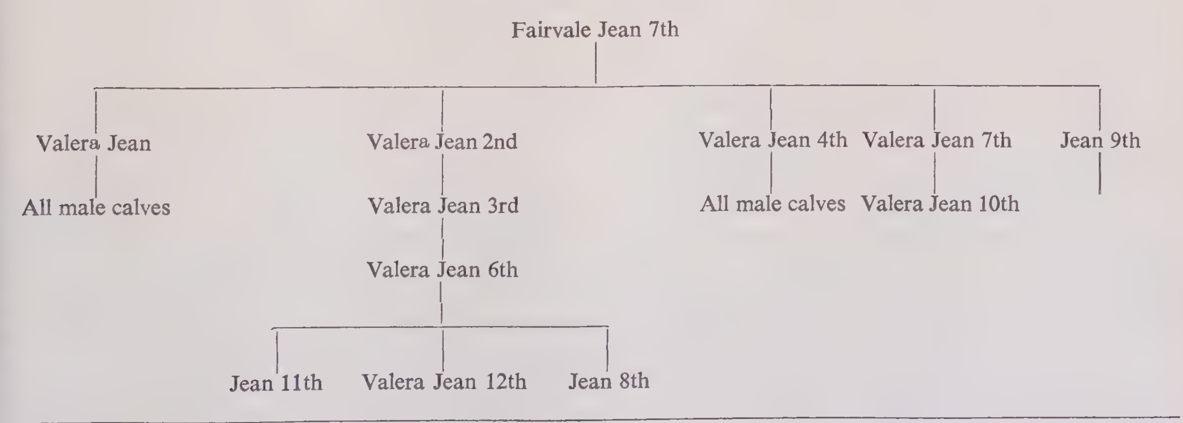
Una Family

Trevor Hill Una, by Corunna Supreme, which was bred by Mr. George Gwynne, Umbiram, and purchased in 1939, was the foundation of the Valera Una family.

Trevor Hill Una was mated with Rosenthal Pendant's Prince and the resultant calf was named Valera Una. The Una's have also proved to be good strong cows that have bred true to type. There are now 54 Una females registered in the A.I.S. Herd Book. Among these are Valera Una 12th, and Valera Una 15th, who have both qualified for the Lifetime Merit Register.

Bulls from this family have also been used at Valera, a well-known one being Valera Monarch (Trevor Hill Una-Alfa Vale Pride 2nd).

Valera Jean Family


Fairvale Jean 7th
Valera Jean
All male calves
Valera Jean 2nd
Valera Jean 3rd
Valera Jean 6th
Jean 11th
Valera Jean 12th
Jean 8th
Valera Jean 4th
All male calves
Valera Jean 7th
Valera Jean 10th
Jean 9th

Jean Family

Another daughter of Corunna Supreme, Fairvale Jean 7th (347 lb. butterfat in 273 days) founded the Jean family. Purchased in 1944, from J. H. Anderson, this animal also has shown her worth as a breeder/producer.

Due to the shorter length of time that the Jean family has been in the herd and the large percentage of male calves produced, the Jean females in the Herd Book number 12. Nevertheless these females have been good producers and have proved their worth as a cow family.

Sire breeding has been practised in this herd; all sires used have been from Advanced Register cows that have given an average butterfat test of 4 per cent. or more.

The value of basing a breeding programme on proven cow families has been amply illustrated by the results obtained in this stud herd. In order to identify cow families it is essential to keep complete breeding records and to have some reliable method of heifer calf identification.

Rain-Grown Cotton Varieties on Callide Valley Alluvials

Does it matter very much which cotton variety you choose to grow under rainfall on Callide Valley alluvial soils? Constant varietal testing at the Regional Experiment Station, Biloela, shows that, as far as yields are concerned, it does not!

Each year a range of varieties both commercial and in the testing stage are compared on the Station's alluvial flats. Yields of the five main commercial varieties averaged over nine successive seasons show a difference of only 28 lb. of seed cotton to the acre:

	Seed Cotton per acre lb.
Empire	804
Miller 610	798
Miller 43-9-0	797
New Mexico Acala 120 ..	790
Miller 41-S	776

These seasons include two very good years when yields averaged over 1,500 lb. to the acre, three average seasons (500 to 900 lb. to the acre) and four poor ones (below 300 lb. to the acre).

It is quite obvious that it would not have mattered much which variety had been chosen. Even if we could say for sure which variety does better under specific conditions we could still not predict the season. Had we been able to predict the top variety each year we would have averaged 876 lb. to the acre.

Miller 610 is a very short staple cotton and does not bring high financial returns. Empire, although of longer staple, is hard to clean after machine picking and the lint tends to be weak when poorly grown under rain-grown conditions. It is not popular, therefore, at the ginneries and may bring lower prices than the others unless hand-picked. While testing of new varieties is progressing it seems that the commercial choice for the Callide Valley should come from the two standard Miller varieties and New Mexico Acala 120.

—*K. G. TRUDGIAN, Agronomist.*

Farm Discussion Groups Are Valuable

By W. D. MITCHELL, Dairy Technologist.

"Order please, gentlemen. Thank you. I am pleased to declare this meeting of the Discussion Group open for business."

These remarks have become quite familiar in recent years in the country areas of Queensland. They herald the commencement of another meeting of one of the several farm discussion groups which have been formed.

What are discussion groups? They are groups formed to exchange information amongst the producing members of a rural community. When a number of people meet and "talk over" their problems they are a discussion group. This idea of farmers meeting together to discuss common problems has been quite popular in New Zealand for many years. In Victoria some 40 discussion groups are now functioning and the oldest group has been meeting regularly for some 7 years. It is a practice which goes on quietly from day to day but the real value of these discussions is sometimes lost because too few people are present.

The purpose of the discussion is to gather all the available information on a particular subject, to pool it and as a result to try to find a true or at least a greater understanding of the problem. There is a very real difference between an argument and a discussion. This needs to be recognised because the purpose of any group is to hear views of members and to add them to one's own personal thoughts. Here information is exchanged and considered, different points of view may be expressed and examined, and a decision may or may not be arrived at.

How do They Function?

In the several discussion groups meeting regularly in Queensland, it has been found that groups have commenced when a particular district problem is pressing. In several instances groups have resulted as an expansion of the annual herd recording meeting of members of a district Herd Recording Group. When members gathered at the conclusion of each recording year to review and discuss cow production results, it was found that common problems of herd management relating to feeding and breeding, problems of farm management relating to pasture establishment, crop rotation and the many other day-to-day topics were being raised at the meeting. What better step could have been taken than to get together and talk these points out?

The usual procedure when forming a group is to appoint a small working committee, with a chairman and a secretary, to make the necessary arrangements with guest speakers or places to be visited. It has been found that the local Departmental officer in the area is a useful man on the committee in the capacity of adviser. He has the necessary knowledge of suitable guest speakers on the wide range of subjects called for by members and in addition his local knowledge of conditions on many farms makes his opinion valuable. It may be useful to have him as secretary for the first few meetings until the group becomes firmly established.

Where formal meetings are held, it is useful to change the chairman of the group at each meeting once the group has become established. This means that all members are given the opportunity of leading the discussion and delivering their own ideas on a particular subject. It is well to remember that the leader in a discussion group should not be a formal chairman through which every question is directed. Free interchange between members is essential. Therefore the leader should not be in a prominent place and careful planning of seating arrangements is necessary. Each person should be able to see the face of any other member—particularly when he is talking. (See (A) and (B). An arrangement as shown in (C) is not satisfactory.

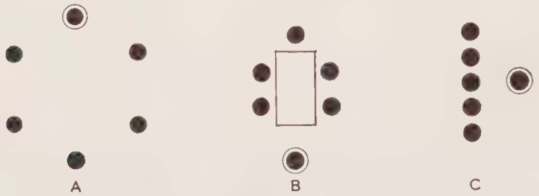


Plate 1

Another useful practice is to conclude any night meeting with an informal basket tea. This encourages continued discussion and we all know that often more discussion takes place after the meeting has closed than during the meeting itself.

It has been found preferable to restrict membership to a small number. This is to enable every member to express his views on the subject. Quite often the quiet retiring person has thought deeply on a subject and has valuable advice to contribute to a problem. It is only in small groups that people can be encouraged to offer sugestions. Numbers could range from 5 to 12 members but if the interest in a district indicates more producers wish to join, it would be preferable to form two small units rather than a large group. These two groups could combine for special functions.

The normal practice in Queensland has been for members to gather in a local public hall to hear addresses by guest speakers. This has brought specialised information to members and has given them a framework on which to develop discussion. However, the practices in other States where members participate in visits to industry premises or where they go on farm walks point the way to other activities. It is when members share their own ideas and experiences in an informal atmosphere that the real value of a discussion group makes itself felt.

A most useful means of commencing activities is to arrange for daylight visits to the farms of all members of the group. A practice which has been adopted widely is to visit a property in the afternoon and then gather in the home of another member to discuss the points of interest seen during the visit. A group could visit an inexperienced farmer or a farmer developing a new property. Here a great deal of benefit will be obtained by the host from the past experiences of his neighbours. How often do we wish we had seen someone do a new job we are about to tackle ourselves just to have been able to get a little "know-how" on the pitfalls which may arise. Sometimes it may be thought there are insufficient items of interest on a particular farm. A moment's reflection will reveal the number of small day-to-day problems which can be discussed profitably in the space of a few hours.

A visit to the local factory is always rewarding. Here cream and milk quality problems can be discussed and the opinions of the manager and his qualified staff sought on cleaning or water problems in the shed.

Programme Details

The type of subjects which are associated with group programmes can be appreciated from the programme arranged by a discussion group on the Darling Downs. This group has been meeting since July, 1957.

Meetings have been held four times a year and speakers have come from both producers and experts in particular fields. Subject matter has ranged from keeping farm records to disease and breeding problems and also on such important subjects as income tax and bookkeeping.

Are Discussion Groups Popular?

As well as increasing in numbers in Victoria, several groups have formed in Queensland in the past 3 to 4 years. In 1957 a unit commenced meetings in the Warwick area and in 1958 groups were formed in the Proston, Kenilworth, Pittsworth and Wandoan districts. Regular meetings are being held in all these centres. In the Goombungee and Beaudesert areas, meetings have also been convened although at less regular intervals and reports are received of isolated

Year	Speaker	Subject
1957	General Film Evening	Discussion Group formation was discussed
	Dairy Adviser	The keeping and use of dairy farm records
1958	Cattle Husbandry Officer	Sterility in dairy cattle
	Herd Recording Supervisor	Herd recording and lessons from it
	N. Halford (Farmer)	Mastitis control on my farm
	Veterinary Officer	Mastitis and its control
	W. Kajewski (Farmer)	The Australian Pig Society
	Dairy Machinery Adviser	Milking machines, operation, testing ; and herringbone bails
1959	Cattle Husbandry Officer	Artificial insemination
	Cattle Husbandry Officer	Practical side of A. I.
	N. H. Mann (Farmer)	Results of and problems in A. I. in my herd
	Pig Adviser	Pigs—their housing, feeding, weaning and diseases
	A. Parker (Farmer)	Leptospirosis control (practical farm approach)
	Agrostologist	Structure and types of Darling Downs soils
	Soil Conservation Adviser	Soil conservation and farm layout
	J. Beardmore (Farmer)	Soil conservation on my property
1960	Herd Recording Supervisor	Grade and Pure Bred Herd Recording results
	Cattle Husbandry Officer	Rearing dairy calves on milk substitutes
	Public Accountant	Farm book-keeping and income tax
	A. Andrewartha	The management and workings of the Darling Downs Bacon Association
	C. Jurgs	

meetings held in conjunction with Departmental officers to discuss such topics as quality improvement, cattle tick and silage making. As the real value of regular, informal discussion, with the benefits to be obtained from the exchange of information between producers, becomes appreciated it is anticipated that more groups will commence to function in the State.

Disc or Tine Cultivation?

Professor A. H. Willis, of the Faculty of Mechanical Engineering in the University of New South Wales, has reported cultivation trials at Wagga in southern New South Wales.

Results showed that under the conditions of these trials, disc cultivation of fallow prior to wheat planting led to better grain yields than where tine cultivation was employed.

Similar trials at the Biloela Regional Experiment Station have been reported by Mr. R. J. Norman, Assistant Experimentalist.

No differences in soil moisture or weed populations between treatments were found and at no stage was there any difference in plant growth. Yield differences were negligible.

The view is held that the varying results obtained at Wagga and at Biloela can be attributed to different growing conditions for wheat at the two centres.

It is possible that mode of cultivation is more critical at Wagga where the crop relies to a great extent on winter rainfall during the crop growth. Wheat crops at Biloela normally rely mainly on subsoil moisture accumulated during the fallow period; as a result the nature of the surface is less important because wheat roots rely to a greater extent on moisture and nutrient stored in lower zones.

The series of trials to compare land preparation methods for wheat at Biloela will be continued.

—*G. H. ALLEN, Senior Agronomist.*

Brucellosis-Tested Swine Herds (As at 1st May, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
H. M. State Farm, Numinbah
Hall. M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warree", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Mannuem Brae" Stud, Mannuem, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., "Culzeen", Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kunawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn," M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzeen", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., "Topcamp", via Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton," M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Pointon, E., Goomburra, M.S. 869, Allora
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Farm Grading Of Flue-Cured Tobacco

By E. J. McDONALD, Senior Adviser in Agriculture.

Farm grading of flue-cured tobacco is the sorting of the cured leaf into reasonably uniform lots so that a few sample hands will show the buyer the type of leaf in the bale for which he is bidding. This article tells how it is done.

Harvesting extends over a period of several weeks because leaves are picked as they reach the correct stage of maturity, commencing from the bottom and proceeding to the top of the plant.

Each harvest, usually referred to as a "pick", contains leaf of a similar type and generally is distinct from leaf of earlier or later picks.

The first essential of grading is to keep the various picks separate in the bulks. There will be some variations within each pick, since plants vary in their rate of growth and their ripening because of differences in soil, plant foods and available water, but, for the most part, each pick will contain similar types of leaf.

. It is necessary to grade tobacco leaf before marketing because there is a very wide variation in quality of leaf from different parts of the plant. The range in prices which buyers are prepared to pay for these various types of leaf is quite extensive. As the manufacturer uses these leaf types in varying proportions in his blending, he needs to know from the sample hands just what type of leaf each bale contains.

With some practice, grading is a fairly simple job because the leaf is sorted according to physical qualities which can be seen and felt. As soon as a tobacco grader recognizes these qualities, he knows what he has to do.

Leaf Types

In most tobacco crops, five different types of leaf will be found. A description of each type will show the differences in appearance and feel.

Lugs.—These leaves are from the bottom of the plant. They are inclined to be round in shape. They are thin, dry natured, dull and open grained. The leaf surface is slightly crinkled and resembles crepe paper.

Cutters.—These are from the position above the lugs. They are distinctly lustrous or glossy and have a rich appearance. They are soft and elastic. They have some open grain on the leaf surface, particularly towards the tip. They are generally the widest leaves on the plant.

Subdivision Leaf.—From the middle of the plant, there is often some leaf of this type. It is thin and dull in colour. It lacks the lustre of cutters. It can be somewhat elastic or tending towards the dry nature of lugs. Such leaf is produced when the normal growth of the plant is affected by nematodes, excess water, stem and leaf diseases or overripeness.

Leaf.—This type occurs above the cutters and below the tips. It is heavier bodied and does not have the lustre, elasticity or open grain of cutters.

Tips.—These are from the top of the plant. They are mostly short and narrow and are heavy-bodied.

Setting the Grades

Grading should commence on the bottom leaf or lugs as these have been in the bulk for the longest period. To set the grades for each bulk, at least a dozen handfuls of leaf should be pulled from the bulk and placed on the grading table. It is essential that these handfuls be taken from all levels in the bulk—from the top to the floor. By grading this leaf first, an idea is given of the types of leaf in that bulk. Otherwise, as the leaf will gradually change from the top to the bottom of the bulk, mixed grading may easily occur.

When setting the grades on the samples which have been pulled from the bulk, the first thing to do is to sort the leaf into two heaps according to texture or feel. For leaf from the bottom half of the plant, the two divisions will be bodied leaf and thin or thrashy leaf. For leaf from the top half of the plant, the thin or trashy leaf will be replaced by heavier bodied, coarser, harsher leaf.

The next step is to take each heap of leaf and grade it according to its colour, size and freedom from damage. The colour divisions are lemon, orange (bright mahogany) and mahogany.

All green leaf should be set aside for later attention. Two divisions for size are generally needed, long and short. A third may be necessary if some leaf is much narrower than the rest. The degree of damage may demand two or three divisions.

The following tables illustrate the types of leaf that may be expected from early and late picks, and set out the differences between the various grades:

TABLE 1

SAMPLE OF GRADES FROM EARLY PICKS

Type of Leaf	Grade	Texture	Appearance	Colour	Size	Damage
Bodied Leaf— (*a*) *Cutters* Wide	1	Soft elastic	Glossy	Orange	Large	Nil to slight
	2	Same	Same	Same	Same	Damaged
(*b*) *Lugs* Less bodied than cutters. More round in shape	1	Dry, crepe-like	Dull Open grain	Orange	Small	Nil to slight
	2	Same	Same	Same	Same	Damaged
	3	Same	Same	Mahogany	Same	Nil to slight
	4	Same	Same	Same	Same	Damaged
Thin Leaf— (*a*) *Subdivision Leaf* Similar shape to cutters or more narrow	1	Little elastic, but mostly dry-natured	Dull. Washed out	Orange	Large	Nil to slight
	2	Trashy, Dry-natured	Same	Same	Same	Damaged
	3	Little elastic, but mostly dry-natured	Same	Mahogany	Same	Nil to slight
	4	Trashy. Dry-natured	Same	Same	Same	Damaged
(*b*) *Lugs* More round in shape	1	Dry. Trashy	Dull. Open Grain	Orange	Small	Damaged
	2	Same	Same	Mahogany	Same	Same

TABLE 2

SAMPLE OF GRADES FROM LATE PICKS

Type of Leaf	Grade	Texture	Appearance	Colour	Size	Damage
Bodied Leaf— (*a*) *Leaf* .. .. .. Fair width; could be lightly sponged	1	Rather stiff. No stretch ..	Close-grained	Orange ..	Large ..	Nil to slight
	2	Same	Same ..	Same ..	Same ..	Damaged
	3	Same	Same ..	Mahogany	Same ..	Nil to slight
	4	Same	Same ..	Same ..	Same ..	Damaged
(*b*) *Leaf* .. .. .. Narrow; could be lightly sponged	1	Rather stiff. No stretch ..	Close-grained	Orange ..	Large ..	Nil to slight
	2	Same	Same ..	Mahogany	Same ..	Same
Coarse Leaf— (*a*) *Leaf* .. .. .. Heavy-bodied. Coarse. Harsh. Includes heavier sponging	1	Rather stiff. No stretch ..	Close-grained	Orange ..	Large ..	Nil to slight
	2	Same	Same ..	Same ..	Same ..	Damaged
	3	Same	Same ..	Mahogany	Same ..	Nil to slight
	4	Same	Same ..	Same ..	Same ..	Damaged
(*b*) *Tips* .. .. .. Heavy-bodied. Coarse. Harsh. Could be sponged	1	Rather stiff. No stretch ..	Close-grained	Orange ..	Small ..	Nil to slight
	2	Same	Same ..	Mahogany	Same ..	Same

All of these grades will not be represented in every crop. The variations in texture and colour, for example, may depend on the amount of plant foods available. Unbalanced nitrogen can cause more trashy leaf from the bottom half of the plant and more heavy, mahogany leaf from the top half. Again, the severity of insect pests or hail storms may influence the amount of damage to leaf.

Grading Leaf From Each Bulk

When the grades are set, all the leaf in the bulk is graded. It will be found that the leaf fits into the grades if a sufficient number of samples have been taken.

Having finished one bulk, the next is then graded after sampling and setting out the types of leaf that bulk contains. Some of the grades occurring in one bulk will be found in the next, but most of the leaf will be of a different type as it will be from a higher plant position.

Grading Immature Leaf

Green or immature leaf should not be mixed with ripe leaf. As mentioned previously, it should be rebulked and sorted later on. It is a good idea to put together all green leaf from the first four or five picks and then grade it. It will be found that slightly immature leaf will have improved in colour and some of it may be put into the grades. The remainder is sorted into three or four grades according to the degree of greenness, size and freedom from damage. Likewise, green leaf from the top half of the plants is put aside and graded after these bulks have been dealt with.

Grading Sponged Leaf

Sponged leaf is often confusing to new graders. Some people make separate grades of this leaf, but in most cases there is no need to do this.

Sponging is a discoloration caused by moisture settling on the leaf during curing. It changes the colour of the leaf but does not alter its other qualities. The more heavily a leaf is sponged, the more mahogany its colour, and it is therefore placed in a lower grade because of its darker colour. Heavier bodied leaf is more likely to sponge and because of this texture it will be placed into one of the lower grades.

Other Factors

There are several other factors which will influence grading, according to the soil type on which the crop is grown or the variety being used. For example, some soils produce "flat" leaf which loses colour very quickly after curing. Some varieties give a proportion of cherry red or mottled leaf which may be similar in other respects but because of its colour should be kept separate to make the grades uniform in appearance.

There is no fixed number of grades which must be made. The number depends upon the evenness of the crop, the manner in which it was picked and the size of the crop.

An even growth in the crops will mean that more leaf of the same types is taken at each harvest. Picking only a small number of leaves, two or three, at a time will result in more even curing as these leaves will be about the same stage of ripeness. More grades can be made from a large crop than from a small one. Too many grades in the small crop will lead to bales with too many partitioned grades of leaf.

To Simplify Grading

The two main points to remember are that leaf should be graded in the order in which it was picked to have as much as possible of the same type of leaf together, and that the first quality to be looked for is the texture or body or feel of the leaf. This is a good indication of the plant position from which it came. Having decided on the texture, the leaf is then sorted into lots to give reasonable uniformity in colour, size and freedom from damage.

Defoliation of Legumes

At the Ayr Regional Experiment Station, dessicants such as sodium chlorate, DNPB, Amizol and PCP have been tested for their defoliation abilities. The test was made on cow-peas at varying rates and at differing stages of growth.

Best results were obtained with PCP applied at the rate of 10 lb. active ingredient per acre, fortified with 2 gal. of mineral oil, in 50 gal. of water.

It was found that an application at this rate, under dry warm sunny conditions would enable a maturing crop of Santiago cow-peas of medium density to be directly harvested 3 days after spraying. Odd green leaves were noticed, but this did not interfere with the all-crop machine used to harvest the seed. The seed sample, however, needed some recleaning.

The cost of such an application has been estimated at £5 per acre.

The amount of foliage to be dessicated may be kept to a minimum by: (*a*) Close planting, forcing pod setting at a more even height; (*b*) Growing the crop during the cooler part of the year.

Other defoliants and dessicants are on the market at present and would be worth investigation. At least one of them (diquat) shows better qualities than PCP for certain defoliation problems.

—*G. VERHOEVEN, Experimentalist.*

Blue Mould In North Queensland

By **I. K. HUGHES, Pathologist.**

In this article, eight important recommendations are made for reducing losses in north Queensland tobacco crops due to blue mould disease.

In accordance with a proposal made at the fourth and fifth meetings of the Queensland Tobacco Advisory Committee a comprehensive survey of tobacco crops with respect to blue mould was carried out in north Queensland during the 1958 and 1959 seasons. Funds for this project were made available from the Tobacco Industry Trust Account. The help and hospitality extended by farmers and others during the course of this survey is gratefully recorded.

The information presented in this article is taken from a critical survey of 350 farms. Average loss due to blue mould was 11·4 per cent. in 1958 and 13·6 per cent. in 1959. However, in the course of the survey, leaf losses of 40 per cent. were recorded whilst stem losses of almost 100 per cent. were encountered on numerous occasions (Plate 1).

The Fungus causing Blue Mould

Blue mould is caused by a fungus, *Peronospora tabacina,* which lives parasitically on the leaf tissues of the tobacco plant. The "blue mould" to which the disease owes its name is the reproductive stage of this fungus and consists of thousands of microscopic single-celled seeds called spores. The spore may be blown with the wind or carried mechanically, for example, on ones clothing or on the bodies of insects.

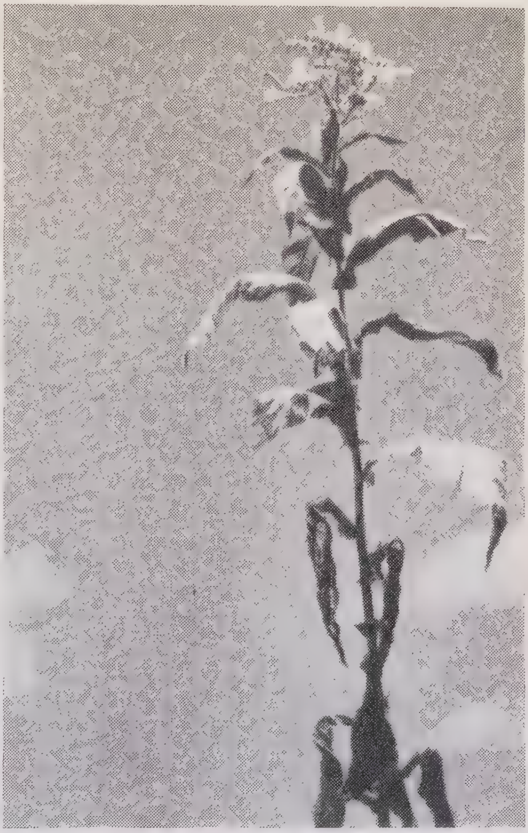


Plate 1

Blue Mould Causing Severe Leaf Loss.

The spore may fall onto a tobacco leaf and there, if it has survived its journey, germinate by producing a very fine thread.

This thread penetrates the outer cells of the leaf and grows throughout the leaf tissue taking nourishment from the cell sap. After several days it grows out to the surface again and produces thousands of spores on the shaded surface of the leaf. In this way one spore produces sufficient inoculum to establish many new infections, the whole cycle taking about a week. The spores are normally formed at night and in a few hours they are mature and ready to be blown about within a crop and cause new infections.

The spores are very delicate and are not long lived. Direct exposure to sunlight kills spores within an hour. The elements which appear to favour spore survival are shaded moist conditions such as occur with light falls of rain. Gusty winds at such a time may distribute live spores over a number of miles.

It can be seen that infection and spread of the disease depends on the presence of spores and conditions suited to their survival and dispersal. If the continuity of spore supply could be broken the disease would be arrested.

Source of Spores for initial Infection

Blue mould cannot live long away from a host plant. The known host plants in north Queensland are, (1) Tobacco, and (2) wild tobacco (*Nicotiana glauca*).

Tobacco

The tobacco host persists as undestroyed crop remains (Plate 2), root and stem suckers (Plate 3) and self-sown seedling growth (Plate 4) commonly called a volunteer plant. The volunteer plants present quite a problem. Of 19 farms inspected in one of the Burdekin irrigation settlements 18 showed volunteer plants with sporing blue mould. This inspection was made prior to seed bed planting in 1959.

Seed spread by wind and mechanical means results in seedling growth along irrigation channels, on headlands, in small crop areas (particularly those being irrigated, for example, peanut, cotton, beans, maize, and truck crops), on used tobacco land allowed to revert to weeds, around barns, and around bulksheds. Seedling growth has been observed 3 years after tobacco has been grown.

Plate 2

A Source of Blue Mould Spores May Be Provided by the Remains of an Undestroyed Crop.

Plate 3
Stem Sucker from an old Tobacco Plant.

Wild Tobacco

Wild tobacco inhabits the Burdekin River catchment area (Plate 5) and it grows on the immediate area of the river bank. The plant prefers loose soil and is commonly found on eroded embankments. Mould was seen on *Nicotiana glauca* in the 1959 season particularly on those plants growing under shaded conditions on the eastern river bank.

Eradication of Host Plants

The eradication of all host plants is the responsibility of the landholder and is now made compulsory by legislation.

The aim of this legislation is to eliminate sources of inoculum so that firstly, all seedbeds escape infection and secondly, the appearance of mould in the field is delayed. This aim is defeated and the time and expense outlayed by growers in host eradication is of no avail if a grower imports seedlings affected with blue mould from some other district. Further there is little point in one grower eradicating his crop in one month whilst his neighbour plans to eradicate his at some later date. The first farm will in all probability have new volunteer seedlings emerged and these will be mould-affected before the neighbour's crop is destroyed. Eradication must be carried out by all growers in the same month.

Plate 4
A Self-Sown Tobacco Plant Growing in the Vicinity of Seed Beds.

Plate 5

Wild Tobacco (*Nicotiana glauca*).

In 1959, prior to field planting, growers of the Dalbeg district through their local progress association attempted to eradicate all host plants of blue mould from their district. Many acres of volunteer plants were eradicated and *Nicotiana glauca* was eradicated from the river frontage. The eradication of *Nicotiana glauca* was accomplished in half a day, the plants being hand-pulled or dug. The scheme was not a success, however, as some growers failed to co-operate and at planting time 5 farms still retained sources of infection. The disease spread from these farms to envelop most farms in the district.

Time of Planting

Unless a break is made in the cropping period throughout all districts, no break in the life cycle of the fungus can be obtained. Unfortunately some growers, and these are few, plant weeks before their neighbours. If a source of inoculum is available these crops will in all probability be mould-infected by the time the majority of field plantings are being made. In this way a concentrated source of inoculum is available early to infect all of the major plantings, and again the time and money spent by these growers on host eradication is a complete loss.

Seedborne Infection

Outbreaks of blue mould in districts far removed from any host plants strongly suggest that this disease is seed-borne. The appearance of mould in 2½ seedbeds out of a total of 10 on one property coincided with the use of a particular seed source.

Until the possibility of seed-borne infection has been proven or disproven, growers should use only seed that has been silver-nitrate-treated. Correct benzol treatment soon after seedling emergence will correct any infection which may be introduced in seed.

Distribution of Spores

By no means must a uniform distribution of inoculum be presumed to exist over the north Queensland tobacco growing areas. Early in the season local outbreaks of blue mould occur close to sources of inoculum. Early outbreaks of blue mould are predictable following a study of the sources of infection. Later in the season when groups of farms become infected and the inoculum concentration is increased many thousands of times, a general airborne distribution of spores may occur. In the 1959 season late in September, such a fall-out of spores was recorded infecting all farms to a distance of 14 miles from the source and possibly farther. The source was approximately 100 infected farms in the Mareeba district.

The spread of inoculum from a source is dependent largely on the prevailing weather conditions. Spore survival is favoured by overcast moist conditions. When conditions favour spore survival and a fall-out of live spores occurs, *all* farms become infected irrespective of age or stage of maturity of plant, watered or dry, on different soil types with different fertilizer and with different cultural practices. This indicates that if a source of inoculum is introduced, cultural practices have little or no effect on the amount of infection which takes place.

Seedbed Infection

Since the discovery of the effectiveness of benzol as a seedbed fumigant to combat mould, seedbed mould has become a much lesser problem. Approximately 94 per cent. of growers were found to maintain seedbeds free of mould.

This percentage is high but cannot be attributed to a high standard of seedbed management. Indeed 24 per cent. of growers merely escaped infection as their benzol technique was wholly inadequate to combat mould. An isolation of 1 to 2 miles from a source of blue mould (that is, a group of plants infected with mould) gives a splendid chance of escape from seedbed infection.

Quite frequently growers who practice inadequate benzol treatments and still produce seedlings free of mould attribute their success to their fumigation technique and assume that this technique will serve in another season. If in another season a source of inoculum is close they will find that their seedbeds become infected. All growers are advised to adopt benzol fumigation schedules as advised by the Department of Agriculture and Stock representative in their particular area.

Points in Benzol Usage

It is evident that more efficient control of the seedbed phase of blue mould will occur when certain features of the treatment are more industriously attended to and when certain attitudes of growers are corrected.

1. Avoid Dry Benzol Trays

Dry trays in the morning indicate that complete evaporation has taken place at some time during the night. The result of this is that the length of time the plants are subjected to a required benzol vapour pressure has been shortened. Common causes are:

(*a*) use of insufficient benzol.

(*b*) use of too large an evaporating surface.

(*c*) use of leaking or very rusty evaporating trays. (Rusty trays tend to allow benzol to "creep" thereby increasing the surface area and rate of evaporation.)

(*d*) covers in poor condition allowing leakage of vapour.

(*e*) ineffective sealing of covers.

(*f*) incorrect calculation of benzol surface required. This commonly occurs where plastic sheeting is used (Plate 6).

Plate 6

Incorrect Calculation of Benzol Surface Required. Blue mould occurred because sufficient benzol was not added to allow for the gaps in the bed not occupied by seedlings.

2. Avoid the Use of too Large an Evaporating Dish

This practice merits special emphasis. A suppression of plant growth around the dish may occur when very large evaporating dishes are used. This effect is caused by the higher concentration of benzol vapour close to the tray and the effect is obviated if the tray size is decreased, and the number of trays increased to give the required surface area. A further important effect is that more efficient fumigation is obtained when more than one tray is used per bed.

3. Avoid the Use of too Large an Evaporation Surface

The evaporation of benzol as recommended by the Department of Agriculture and Stock does not, nor is it intended to, maintain a saturated benzol vapour pressure. Benzol burn may be experienced in dry seedbeds where the evaporation surface is over 2 sq. in. per sq. ft. The common symptoms caused by too large an evaporation surface on moist seedbeds are a plant stunting and leaf harshness with puckering. On a dry seedbed, leaf margin and tip burn may result.

4. Watering Before Covering

Frequently, growers lightly water very dry seedbeds before benzol fumigation as they fear that benzol burn may occur. Watering of seedbeds before benzol fumigation decreases the efficiency of the benzol fumigation. It is of particular importance to note that in a survey of 350 farms the only instances of benzol burn were recorded where more than 2 sq. in. of evaporating surface had been used to each sq. ft. of bed. The most pronounced symptom was leaf margin damage.

5. Covering too Early and Uncovering too Late

Where seedbeds are uncovered after 9.00 a.m. a leaf scorching due to heat may occur. This effect is not confined to the leaf margins but may involve the whole leaf, particularly with young leaves. Frequently this type of scorching occurs on the side of the seedbed most exposed to the sun. Where plastic covers are allowed to rest on the leaves, the effect is accentuated.

6. Covering too Late

Many growers cover too late in the afternoon. Sporing blue mould has been observed in seedbeds in north Queensland where covering has been commenced after 5.30 p.m. At this hour the covers do not warm up, and the evaporation rate is slower, resulting in an insufficient vapour pressure early in the fumigation period.

7. Infrequent Covering

Sufficient covers must be available for the protection of all of the seedlings needed for field planting. Growers are advised to estimate carefully the number of seedbeds required to ensure themselves of adequate planting material. Planting of extra seedbeds where extra seedbed covers are not available invariably leads to infrequent covering of some beds. These beds are then exposed to infection, and once infected are a danger to all beds. Frequently growers leave their seedbeds uncovered for a number of days before field planting. This practice is not recommended as these beds are thus exposed to infection before field planting. Seedlings should be benzol treated up to the day of transplanting.

8. Incorrect Diagnosis of Seedbed Maladies

Even experienced growers tend to attribute numerous seedbed disorders to benzol damage. Cold injury, frosting, malnutrition, fertilizer or chemical burn are often falsely attributed to benzol damage. Growers all too frequently alter what have been correct benzol schedules when such damage occurs, thereby exposing their seedbeds to blue mould infection.

9. Spilling of Benzol whilst Filling Trays

Liquid benzol will quickly burn and kill tobacco seedlings. This damage is easily recognised and is confined to the area around the seedbed trays.

Preventive and Curative Action of Benzol

As benzol is slightly toxic to the plants, growers are hesitant to begin fumigation before the leaves are five-eighths of an inch in diameter. When seed germination is erratic, benzol treatment may be delayed even longer. When a local source of blue mould inoculum exists, infection has often occurred prior to benzol treatment. In this case fumigation treatment, as recommended by Departmental Advisory Officers, will prevent the spread of the disease to unaffected plants, whilst mildly affected plants, which have not reached the stem infection phase, will be cured.

Generally by the time infection has been observed some plants have developed infection of the stem and/or growing point. These plants may be recognised by the way their larger leaves lie appressed to the ground, by the cessation of terminal growth, by a darker green colour of the largest leaves, by a thick leaf texture and loss of leaf venation. A closer examination reveals a brown discoloration of the stem, and dissection of the plant shows brown discoloration of the water-conducting tissues. Where infection has taken place when the seedlings are very small, stem-infected plants are soon overgrown by their healthy neighbours.

When infection occurs near the planting-out stage, it may be difficult to diagnose stem infection. A close examination often shows a discoloration of the stem near the point of attachment of the affected leaves, and a stem brittleness with a well-defined marginal cracking. Familiarity with the disease leads to a remarkable efficiency in plant selection from such beds. However, most growers who experience a late occurrence of seedbed mould would be very well advised to discard the infected seedbeds; particularly those which show stem mould infections. A late stem infection will not be cured by normal benzol application.

Benzol, correctly applied, will eliminate the possibility of "masked infection", that is, the carriage of non-sporing blue mould from the seedbed to the field. Any infections which may occur will be eliminated before they develop into the permanent stem infection stage.

Build-up of Blue Mould in a Field

If a grower uses healthy planting material it is unusual to see blue mould infection before the plants are 3 weeks old. Initial infections before 3 weeks indicate that a source of inoculum is very close.

Economic loss of a leaf per plant may be expected 3 weeks after the first mould spots are seen in a paddock. The first infections are usually small in number—10 spots per acre being an average aerial infection. These are overlooked as a rule by a grower and it is not until the spores from these spots have started new infections that the disease is noticed. If mould attacks a crop which is nearing maturity and shaded conditions prevail within that crop the disease will spread much more rapidly and in 2 weeks severe damage may occur.

Blue mould damage is often much more severe close to points of initial infection. This results in what may be described as a "hole in a crop," that is, roughly circular areas of much more severe infection.

Should a grower use mould-infected seedlings as planting material, mould will be seen immediately and the result is very frequently severe infection by the time the plants are 2 weeks of age. The field planting of mould-affected seedlings presents two problems. Firstly an early mould infection in a planting will often result in severe losses due to stem mould, and many plantings such as these are abandoned. Secondly, and most importantly, the field planting of mould infected seedlings establishes within a district a concentrated source of inoculum. Air-borne spread from such a source may easily lead to infection on farms as far as 4 miles distant. Aerial spread over 14 miles has been recorded. In this case the source of inoculum was very large—100 severely infected farms.

Should mould-infected seedlings be field-planted by a grower who is planting early, a concentrated source of inoculum is established early in the season and is available to infect the main district plantings as soon as they are set in the field. This may lead, and certainly has in the past led, to very severe economic loss due to stem mould on plantings adjacent to the contaminated farm.

Every year a small percentage of growers plant out seedlings infected with blue mould. Every year some growers for one reason or another are obliged to buy or beg seedlings. Very frequently the seedlings obtained are blue mould infected. The introduction and field planting of this material establishes sources of inoculum in what may have been a disease-free district. This traffic of blue mould infected seedlings and the field-planting of these is one major factor which must be overcome if any control of blue mould is to be obtained.

Growers *must not* plant mould-infected seedlings.

It is well to consider the build-up of blue mould in time. If clean seedlings are planted it is unusual to have mould earlier than 3 weeks from the planting date. Three weeks after the first infection a severe infection may be recorded (that is, 6 weeks from field planting). At this time the concentration of inoculum is sufficiently large for widespread aerial spread of blue mould. However, if mould-infected seedlings are planted, a concentrated source of inoculum is established when the plants are 2 weeks of age. Thus by the field planting of mould-affected seedlings the progress of blue mould is hastened by at least 4 weeks.

The *time* of appearance of leaf mould is most important in a consideration of stem mould losses.

Stem Mould

Of recent years, plant losses through stem infections of tobacco with blue mould have caused concern. Seedling symptoms have already been described. Field symptoms vary considerably.

The planting out of seedlings infected with blue mould in the seedbed has been known to result in almost 100 per cent. stem infection at an early age. Numerous records are available of field plantings being abandoned within 4 weeks of planting.

Infections which have originated in the seedbed usually show as stunted plants which lose the seedling leaves and exist as erect plants with a tuft of small crinkled leaves at the top. Growth often ceases. The stems show a cracked appearance resembling sunburn and are very brittle. Bending of the stems results in a crack, the cracking often being audible. Cutting along the stem shows a brown discoloration of the water-conducting tissue starting from the leaf junction where infection has taken place. The brown discoloration generally extends to the growing point.

Plate 7

Tobacco Plants Affected by Stem Mould.

With plants exposed to infection after field planting the symptoms may be different. Frequently an infection close to the growing point gives a rosette appearance to the plant with a stopping of growth.

When the infection does not stop growth, the plant may persist with a distinct one-sided growth or with a general stunting. The leaves of such plants are generally restricted in size, harsh in texture and the plant adopts an upright rigid appearance (Plate 7). Cutting of the stem low down will show a candy yellow or brown discoloration extending into the wood. Such plants are brittle and easily broken off.

Frequently if the infection is late, stem mould may be present but remain unobserved. A plant of normal stature and appearance may be produced. Stem cutting will show the brown discoloration of the water conducting tissue. This discoloration starts at the leaf where infection takes place. A careful examination of the stem may show a furrow running along the stem for a short distance. Collapse at this point is common and may occur with or without mechanical damage. Frequently the stems merely collapse and do not break. Growers have been known to prop fallen plants but this practice is hardly economic and the raising of fallen plants often results in a cracking at the point of collapse.

During the 1958 season, 30,000 stems were cut on 150 farms and records made of the presence or absence of the brown discoloration. No stem discoloration was found where crops had experienced no leaf mould (unless of course, plants showed obvious mechanical injury or leaf miner damage). The worst stem mould occurred where plants were infected with leaf mould at a very early age. Table 1 shows the average per cent. stem infection for plantings which showed the first leaf infection *before* 3 weeks and for plantings which showed the first leaf infection *after* 3 weeks.

TABLE 1
CORRELATION OF THE AMOUNT OF STEM MOULD WITH THE TIME OF INFECTION WITH LEAF MOULD

Time of Infection with Leaf Mould	Per Cent. Stem Mould
First leaf infection *before* three weeks	23·5
First leaf infection *after* three weeks	9·4

TABLE 2
CORRELATION OF STEM INFECTION AT HARVEST WITH LEAF MOULD SEVERITY AT 6 WEEKS

Average Leaf Mould Severity at 6 Weeks	Per Cent. Stem Mould at Harvest
No infection	0
Scattered spotting	7
Concentrated spotting	20
Severe spotting (leaf loss)	34

It was mentioned in the previous section that severe leaf loss normally follows 3 weeks after initial leaf infection. Severity ratings for blue mould were taken on 150 crops 6 weeks of age and subsequent stem mould at harvest time recorded for these crops. Table 2 shows the result of these records.

It may be seen from Tables 1 and 2 that to prevent stem mould it is essential to delay the appearance of leaf mould thereby reducing the severity of the disease while the plants are young.

Fungicides

During the 1958 and 1959 seasons, detailed crop histories were kept on fields which were sprayed with the fungicide zineb. In the Burdekin in 1959, the average leaf loss from blue mould on 32 farms on which the tobacco was not sprayed was 12 per cent., while the loss on 29 farms which had been sprayed was 0·7 per cent.

In the Mareeba-Dimbulah district only a few growers used zineb on a field scale. The average leaf loss on 52 farms unsprayed was 9·8 per cent. and on 7 farms sprayed was 4 per cent.

The success of zineb is attributed to the preventative effect of the spray. Earlier in this article it has been shown that initial blue mould infections occur through the establishment of few isolated spots within a field and build up occurs around these points. Zineb-spraying prior to infection seems quite capable of controlling the disease under these low concentrations of inoculum. Under epidemic conditions zineb loses its efficiency and a search is still being made for a fungicide which can be relied on at all times.

TABLE 3
ANALYSIS OF MOULD LOSS AND LEAF VALUES WITH AND WITHOUT ZINEB SPRAY, MAREEBA, 1959

No. of Farms	Average Leaf Loss %	Zineb Usage	Average Price of Cured Leaf (Pence per lb.)
7	4·0	Yes	150·5
*16	4·0	No	146·9

* These farms were selected as having the same average per cent. leaf loss as those sprayed.

TABLE 4
ANALYSIS OF MOULD LOSS AND LEAF VALUES WITH AND WITHOUT ZINEB SPRAY, BURDEKIN, 1959

No. of Farms	Average Leaf Loss %	Zineb Usage	Average Price of Cured Leaf (Pence per lb.)
24	0·7	Yes	125·3
26	14·0	No	124·7

Analyses of mould loss, zineb usage and leaf values have been compiled for the 1959 season. These are shown in Tables 3, 4 and 5.

TABLE 5
ANALYSIS OF LEAF MOULD LOSS AND LEAF VALUE, MAREEBA, 1959

No. of Farms	Average Leaf Loss %	Zineb Usage	Average Price of Cured Leaf (Pence per lb.)
16	4·0	No	146·9
17	8·5	No	141·7
16	17·0	No	141·0

Zineb-spraying does not appear to reduce the value of the leaf. It is of interest to note from Table 5 that leaf value is altered very little by mould incidence.

TABLE 6

EFFECT OF ROW DIRECTION ON DAMAGE BY LEAF MOULD

——	East–West			North–South		
	No. of Farms	Average % Loss	Range % Loss	No. of Farms	Average % Loss	Range % Loss
1958						
Mareeba–Dimbulah . .	37	10·5	0–30·6	30	7·6	0–19·4
Burdekin	26	13·0	1·7–39·6	3	7·2	6·7– 7·4
1959						
Mareeba–Dimbulah . .	20	13·3	0–40	27	8·9	1–21
Burdekin	28	12·5	0–30	6	11·6	5–28

Row Direction and Blue Mould Development

During the course of these investigations factors have been observed which affect the severity of mould once initial infection has occurred.

The effect of row direction is very pronounced. An east-west planting favours the disease, probably due to the shading of one plant by its neighbour. The effect of morning shade was noted also when *Nicotiana glauca* plants were being inspected for blue mould infection. Those plants on the eastern river bank showed infection whilst those on the western bank showed no infection.

Table 6 shows an analysis of per cent. leaf loss for each row direction. Recordings from different districts are listed separately as are the years when observations were made. The number of farms from which averages were made and the range of per cent. leaf loss are included.

Stem Mould in Relation to Row Direction

During the 1958 season, stem cutting of 30,000 plants was carried out and recording of discoloration was taken as an indication of the presence of stem mould. The relation between row direction and incidence of stem mould is shown in Table 7.

TABLE 7

CORRELATION OF STEM INFECTION WITH ROW DIRECTION, 1958 SEASON

Row Direction	Number of Farms	Average % of Plants with Stem Infection	Range %
North-south . .	36	12·8	0–68
East-west . .	56	19·9	0–83

During the 1959 season, stem mould was recorded by noting the appearance of obviously affected plants whether they were systematically affected (stunted or with one-sided growth) or lodged. The numbers of farms affected are shown in Table 8 for the Mareeba-Dimbulah district for each row direction.

TABLE 8

CORRELATION OF STEM INFECTION SYMPTOMS WITH ROW DIRECTION, 1959 SEASON

Row Direction	No. of Farms	Per Cent. of Farms with Stem Infection Symptoms	Per Cent of Farms with Lodged Plants
North-south . .	27	26	22
East-west . .	20	50	35

Row Width and Plant Spacing

A survey of 150 farms in 1958 indicated that leaf mould was less where plant spacings and row widths were greatest. These results were not supported in the 1959 survey.

Water Usage and Blue Mould Development

The application of irrigation waters early in the life of the crop has been found in the 1958 and 1959 seasons not to increase mould loss. Table 9 shows an analysis of per cent. leaf loss at harvest time for plantings subjected to varying water applications early in the life of the crop. The number of farms inspected for each group is included in brackets.

TABLE 9

Average Leaf Loss Per Cent. for Different Water Applications Early

Year	Low Water	Medium Water	High Water
1958	10·7 (37)	10·7 (63)	7·6 (13)
1959	10·6 (72)	9·0 (70)	7·6 (15)
Average ..	10·6 (109)	9·8 (133)	7·6 (28)

Stem Mould in Relation to Irrigation Practices

The application of irrigation waters early in the life of the crop and the subsequent expression of stem mould has been noted during the 1958 and 1959 seasons. Table 10 shows the per cent. of plants affected with stem mould for the various irrigation groupings. The data for 1958 was obtained by stem cutting whilst that for 1959 represents lodging. The number of farms is in brackets.

TABLE 10

Average Stem Mould Per Cent. for Different Water Applications Early

Year	Low Water	Medium Water	High Water
1958	16·3 (66)	15·6 (59)	10·6 (15)
1959	8·0 (38)	3·8 (63)	0·1 (14)

The alleviation of stem mould by application of more water early is thought to be due to the shortening of the life of the crop.

Recommendations for Reducing Losses Due to Blue Mould

Arising out of the survey just described, there are a number of suggestions which if carried out would greatly lessen or even eliminate the present blue mould hazard:

1. Standardise planting dates to ensure that no grower builds up a large source of inoculum prior to the field planting of the main elements of the district crop.

2. Implement legislation for the eradication of host plants for 2 months prior to the date of first planting.

3. Use seed obtained from a disease-free source.

4. Have available a source of blue-mould-free seedlings to ensure that no grower need introduce mould-infected plants if he finds himself in short supply.

5. Encourage the planting of tobacco in a north-south direction and the field use of fungicides.

6. Minimise the movement of field men from infected areas into disease-free areas and similarly discourage the movement of plants.

7. Adopt practical measures to shorten the growth period of the crop.

8. Adopt crop rotations with a view to eradicating volunteer plants.

Weeds In Grain Sorghum

In order to check weed growth in grain sorghum and allow the crop to smother the weeds, graingrowers should follow these recommendations:

(1) Spray your grain sorghum crops when 3 to 6 in. high.

(2) MCPA is the safest formulation to use.

(3) Up to ½ lb. of active ingredient to the acre is a safe rate.

(4) Spraying in the flowering stage cannot be recommended.

Practical application of this rate in field crops has been confirmed, and, for the more difficult weeds the amine formulation at the same rate can be used.

When the loss in yield due to weeds is taken into account the possible slight reduction in yield caused by the use of 2,4–D amine at ½ lb. active ingredient per acre becomes relatively unimportant. It is certainly much less than the reduction in yield likely to occur if the area is replanted or if a further planting rain does not occur.

—*S. R. KLOSE, Adviser in Agriculture.*

orchard and garden

Tomato Breeding.—The tomato breeding plots at the Redlands Experiment Station, Ormiston, were open for inspection one day in November. Some 80 growers were shown over the plots by Mr. C. N. Morgan, Senior Adviser in Horticulture, and specialist officers associated with the research project were present.

Precis of comments by Departmental officers are given—

(1) *C. N. Morgan,* Senior Adviser in Horticulture:

Tomato production in districts near Brisbane has followed a definite pattern for some years past with a trend towards improved production methods and better varieties.

When a variety declines in commercial importance, it obviously has some major defect in yield, fruit quality or susceptibility to disease. At the present time, Grosse Lisse and its strains dominate the production field in the Redlands district. Following its introduction in 1942, it soon became popular. Unfortunately, it is not a variety for all seasons of the year although growers try to make it perform this impossible task. It is essentially an autumn variety; setting may be poor in the winter and fruit quality below standard in the spring. It is, however, the best Globe variety for the metropolitan area.

It is dangerous for the industry to rely entirely on a single variety of tomato. Varieties do not last indefinitely and Grosse Lisse has obvious weaknesses. The Department of Agriculture and Stock is conscious of the need for a wider range of commercial tomato varieties in the Redlands district. The material available for inspection at the Station and the talks you will hear from specialist officers will give a "close up" of the plant breeders' problems, the techniques used to investigate them and, perhaps, a picture of the tomato varieties you may be growing in the near future.

Trends in Tomato Breeding

(2) *H. M. Groszmann,* Senior Plant Breeder:

Ten years ago, the main tomato varieties in the Metropolitan district were Grosse Lisse in the autumn, Salads Special in the winter, and Grosse Lisse and Sioux in the spring.

The industry was much too dependent on one variety, Grosse Lisse, and all the varieties listed had their defects. Grosse Lisse could suffer severely from target spot and bacterial wilt in the autumn, and often set poorly in the spring. The best winter variety, Salads Special, did set well in the cold but its fruit was rather small and, with the increased incidence of leaf shrivel virus, winter plantings of Salads have greatly declined.

The spring crop faces several hazards. It has to grow and set at low temperatures and then go on to mature its crop in the warm weather when fusarium wilt and nematodes add to its difficulties. The variety Sioux has already gone out of production because of the softness of the ripe fruit and the plant's susceptibility to fusarium wilt.

The Department of Agriculture and Stock set out to improve the position in several ways: by introducing and testing new varieties, by testing new varieties introduced by seed firms and by breeding to combine desirable characteristics from different varieties.

Altogether over sixty introduced varieties have been tested but, on the whole, those developed in other countries do not fit our conditions.

Only two of the introduced varieties, Manalucie and Ace, appear to merit wider testing by growers.

There are two main approaches to the breeding work, the production of first generation or F_1 hybrids and the breeding of new fixed types.

When two varieties are crossed, the first generation cross is generally very uniform and often more vigorous and productive than its parents. It may also combine the desirable qualities of the parental varieties. However, the first generation hybrid is not a fixed variety, and plants raised from its seed are a mixture of types intermediate between the two parents. If a hybrid is considered suitable for commercial production, it is necessary to produce all the seed by hand pollination between the two parental varieties.

Numerous F_1 hybrids have been tested in autumn, winter and spring. While they show some promise in combining fruit quality and disease resistance in the spring, their outstanding performance is in the winter. For example, hybrids between Grosse Lisse and Salads have much larger fruit than Salads and set much better than Grosse Lisse. This cross performed very well in yield trials at Redlands last year.

To produce fixed types combining the desirable characteristics of different parental varieties, the breeder must select the most promising plants, generation after generation, until his selections breed true for the characteristics he is seeking.

The breeding plot now growing at Redlands contains a number of such selections in the fifth and sixth generations after the initial crosses between a nematode and wilt resistant variety and the standard varieties, Q2 and Q3. The object of this work was to combine the fruit quality and production of Q2 and Q3 with the disease and pest resistance of the other variety. Some of the selections are now at the stage where they appear to merit wider field testing.

However, it must be emphasised that the tomato is a product of very intensive breeding over a long time and the standards set by existing commercial varieties such as Q2 are very high. Once the breeder leaves the established varieties in search of some necessary characteristic, it takes considerable time and work to return to these standards. It also takes considerable testing to give some assurance that the standards have been obtained.

Disease Resistance in Tomatoes

(3) *J. Johnson,* Plant Pathologist:

Two avenues of investigation in the field of disease resistance are being pursued. This aspect will always be an important one in tomato improvement work on this Station.

The first concerns the virus diseases, leaf shrivel and mosaic. Although a large number of tomato types have been tested, none has proved immune to leaf shrivel. However, one (T.S. 55), shows some tolerance to leaf shrivel but is far from a commercial type and a long breeding programme would be needed to bring about the necessary improvement. Hybrids with T.S. 55 are also leaf shrivel tolerant; their main deficiency is the small size of the fruit. Mosaic resistance has appeared in two other introduced varieties, and no doubt this will be considered in future breeding work.

The other phase of the work concerns diseases of the warmer weather, particularly fusarium wilt and target spot. At least one line which has been under test for some time appears to have prospects. It is a Grosse Lisse hybrid possessing many of the good features of that variety together with resistance to the two diseases mentioned. Other diseases to which some of these test varieties are resistant are leaf mould and grey leaf spot.

Growers have shown considerable interest in reports from the Murwillumbah area that yellow top has been successfully countered with meta-systox sprays. Many seem to think that yellow top is also troublesome here. This is not the case as the disease is uncommon here. Most of the yellowing of tomatoes in the Redlands District is due to mosaic in its yellow (aucuba) form. It is not spread to any extent by aphids. Nor is the spread of leaf shrivel prevented by spraying with meta-systox although, in this case, aphids are involved and some retarding of the spread may be achieved.

Fertilizer Placement in Tomato Seedbeds

(4) *R. C. Menary,* Plant Physiologist:

The Senior Plant Breeder pointed out that it is possible to produce disease resistant varieties of tomato with a desirable appearance and good eating quality. Even so, it must be remembered that good, healthy plants are always less susceptible to disease than unthrifty ones. Until we have the "perfect" tomato, growers can lessen the risk of disease losses by keeping the crops healthy. To do this, they must first start by using only healthy seedlings for transplants.

Usually tomato seedlings produced in the colder months grow slowly and have a deep purple appearance. They are also very susceptible to target spot and other diseases.

Trials conducted at Redlands Experiment Station this winter have shown that it is possible to increase the growth rate of tomato seedlings during the colder months. This rapid growth was induced by placing the seedbed fertilizer in a narrow band under the seed. The usual practice is, of course, to mix the fertilizer with the soil before seeding.

When the fertilizer is placed below the seed, the small seedling roots can obtain essential nutrients as soon as germination begins. It is thought that phosphorus is the nutrient most sought after by seedlings during the cold weather. By placing the fertilizer in a narrow band, 1 in. under the seed, the concentration of phosphorus immediately under the germinating seedling is greater and there is less chance of getting phosphate fixation by the soil.

The trials contained the following treatments: (*a*) A 5:13:5 mixture at the rate of $\frac{1}{2}$ lb. per sq. yd. mixed with the surface soil; and (*b*) A 5:13:5 mixture at the rate of 1 oz. per yd. of seedbed row placed in a narrow band 1 in. below the tomato seed. After a period of 8 weeks the seedlings grown on the banded fertilizer were at least twice the size of those grown in the normal way with the fertilizer mixed in the soil before sowing.

During the colder months, a banded fertilizer is worth a trial in your tomato seedbeds. A rate of 1 oz. per yard of row placed 1 in. below the seed has given excellent results at the Station.

Gross Engine Power — What Is It?

The Tractor Testing Committee has expressed some concern at confusion arising from the use of the term "Max. engine horsepower—gross". On this basis a tractor of 50 or so drawbar horsepower had been described as a 100 HP tractor.

Mr. G. H. Vasey, Officer in Charge, explained that gross engine power, or any similar term, can only refer to a stripped engine on a factory test bed; no fan, no generator, air cleaner, exhaust muffler, water pump and so on. All these power-consuming, but nevertheless essential, auxiliaries would reduce the so-called gross engine power by 15 per cent. or so.

The gross engine power, he said, is of academic interest, mainly to the engine designer or to the production line checker; the term has no significance for the prospective user, and would better be dropped from advertising. But the user is entitled to know the real power available at the engine crankshaft, so as to have some basis for estimating the power losses in the transmissions to the various outlets, pto, belt pulley, and drawbar.

If the tractor is equipped with a hydraulic torque converter these losses can be quite high, of the order of 15 per cent., for the converter alone, with successive losses in the mechanical transmission, track or wheel slip, and other traction resistances, a drawbar power on the test track of only about 50 per cent of the gross engine power could be expected.

Australian tractor tests are now conducted so as to reveal the true shaft horsepower of the fully equipped engine as well as the power available at the outlets.

Queensland Fauna Sanctuaries

By C. ROFF, Fauna Officer.

The following is an index of the sanctuaries outlined in Map 28:

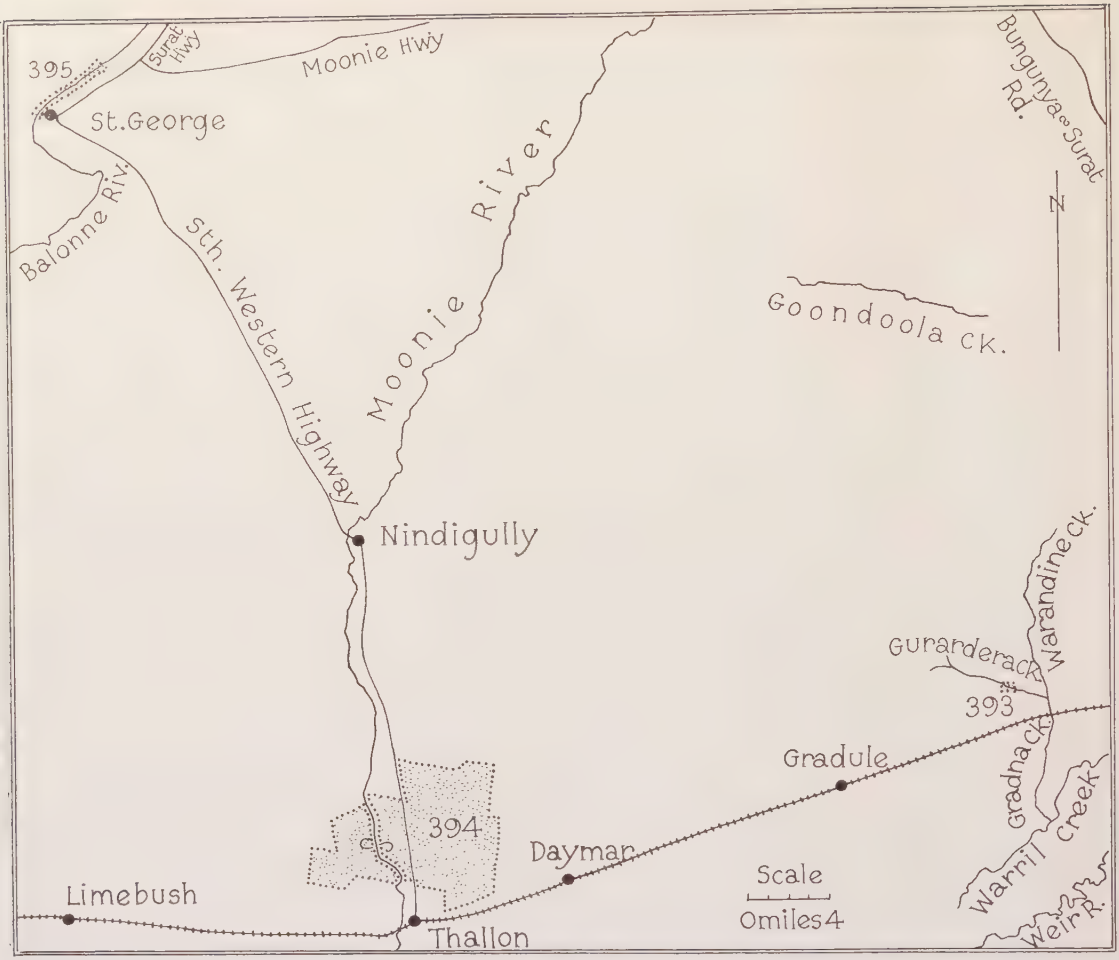
Index No.	Sanctuary	Area in Acres
393	Gradna Lagoon and part of Gurardera Creek, Talwood	320
394	"Bullamon Plains," Thallon	29,154
395	Balonne River Sanctuary, St. George	256

The following is an index of the sanctuary outlined in Map 29:

Index No.	Sanctuary	Area in Acres
396	Dynevor Lakes, Eulo . .	36,430

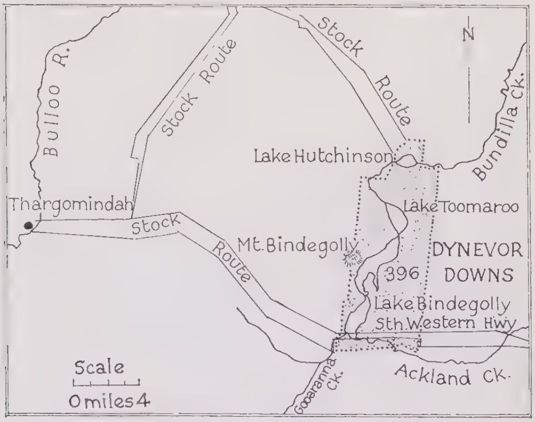
Plate 16

Grey Teal on "Bullamon Plains" Sanctuary.


395
St.George
Surat Hwy
Moonie Hwy
Balonne Riv.
Sth. Western Highway
Moonie River
Bungunya-Surat Rd.
N
Goondoola Ck.
Nindigully
Warandine Ck.
Gurarderack
393
Gradule
Gradna Ck.
Warrill Creek
Weir R.
394
Dayman
Scale
0 miles 4
Limebush
Thallon

Map 28

Map Showing Sanctuaries in Part of Fauna District No. 4. The sanctuary boundaries (as at December 31, 1958) are delineated by dotted lines enclosing the stippled areas.


Bulloo R.
Stock Route
Stock Route
N
Bundilla Ck.
Lake Hutchinson
Lake Toomaroo
Thargomindah
Stock Route
Mt.Bindegolly
DYNEVOR DOWNS
396
Lake Bindegolly
Sth.Western Hwy
Gooaranna Ck.
Ackland Ck.
Scale
0 miles 4

Map 29

Map Showing Sanctuary in Part of Fauna District No. 4. The sanctuary boundary (as at December 31, 1957) are delineated by dotted lines enclosing the stippled area.

◆

Removing Spots

Enthusiastic spring-cleaners will probably have come across some spots on furniture and fabric that have escaped their notice during the winter months.

These may be on woodwork, walls, furnishings, or luncheon cloths.

The following methods of removal, supplied by Miss Nancy Foskett, Senior Extension Officer, Women's Service, N.S.W. Department of Agriculture, should help you get rid of them.

White spots caused by moisture which have eluded general scrutiny should respond to this treatment:

First remove the furniture wax by rubbing the spot with a cloth and warm water, with a little turpentine added if paste wax was used to polish.

Then put linseed oil or oil of wintergreen on a clean cloth and rub lightly with the grain of the wood—rubbing beyond the white spot.

If the finish becomes sticky, stop rubbing; wait until it is dry, and if the white spot has not been removed, repeat the oil rub.

Lastly, apply a new coating of wax.

For stubborn grease spots on dark solid-colour cottons—luncheon cloth or napkins, upholstery, cushion covers—try liquid shampoo.

Moisten the spot with warm water; rub liquid shampoo well in; roll up for a few minutes, then wash in hot water and detergent—but be sure of colour-fastness before you use that *hot* water. If in doubt use warm water.

Drawer Partitions

For those who "can't find anything in that drawer," partitioning the drawer so that like things may be stored in the one compartment is recommended.

In kitchen drawers this not only saves time but saves wear on the articles and, in the case of knives, sharp-edged and pointed tools, is much safer.

For knives, of course, one of the new types of racks, placed out of the reach of tiny hands, is an even safer and better method of knife storage.

Whether scraps of wall-board, ply, stiff cardboard, or wood from a cheese box is used for the partitions, be sure to make them removable to simplify cleaning and lining.

Sometimes a wooden or plastic cutlery box can be bought to fit a drawer.

Failing this, wood or cardboard boxes can often be found to fit into the drawer and, when painted, are quite satisfactory.

A plastic sewing-tidy tray is ideal for a dressing table drawer.

A plastic fly-box from the fishing counter of a sports store is just the thing for ear-rings and small pieces of costume jewellery, whether in a drawer or in a holiday suit-case.

The "dead" space in the top half of a deep drawer can often be put to work by having a tray that will slide from front to back, or side to side.

If the bottom half of the drawer is partitioned the tray could run on the partitions; if not, a length of beading tacked down either end, or along the back and front of the drawer, would provide runners.

The tray should be only half the width or length of the drawer, to allow easy access to the bottom of the drawer.

A deep drawer in the kitchen could be partitioned off from side to side to give filing-type storage for cake pans.

The distance between each divided would be governed by the depth of each cake pan.

Is Your's a Safe House?

In these days when we are being constantly reminded of the need for road safety it is possible that we tend to overlook other dangers in our everyday surroundings.

Statistics show that many accidents occur in and around the home—especially accidents to children.

Disorder and fatigue are two of the factors that cause accidents.

Both can be eliminated or at least reduced by a house being designed to minimise hazards and to make efficient use of space.

Areas that have related activities and uses should be placed close together and on the same level.

For example, sleep-outs, bedrooms, and bathrooms, should be close together, the drying area near the laundry, and play area for pre-school children near mother's main work area.

Other requirements for safer living include:

Short, simple traffic routes, free from obstruction such as occasional furniture; general passage ways should be at least 3 ft. 4 in. wide.

Sufficient storage space in every room for the articles needed there.

Adequate non-glare light—both natural and artificial.

Level floors.

No sharp corners or projections.

Careful placement of doors and windows—and cooking ranges.

Safe stairways, well lighted.

No *single* steps.

Rooms large enough to hold the furniture required, and "room to move" for the occupants.

Home Sewing Speed-up Hints

Well-made, attractive garments can be made in less time and without sacrificing workmanship and serviceability by simplifying sewing.

In addition to contributing to time-saving by selecting easily handled fabrics, simple but well designed styles, and the right sized pattern, much can be achieved by simplifying construction methods also.

Too much attention to detailed neatening and finishing can sometimes spoil the whole effect of line and style of a garment.

The well-illustrated, step-by-step instruction sheet is one of the best aids to the home dressmaker.

Each step is planned to ensure ease of handling and quick construction.

In addition it is wise to study one of the dressmaking books published by the various pattern-making companies.

All are clearly and well illustrated, are revised frequently and are not too expensive.

Another aid is to observe the methods employed on ready-made garments—some of them can be adopted by the home dressmaker to her advantage.

Eliminating all tacking is not necessarily time saving—at times it can result in a whole section having to be unpicked, reset, tacked and restitched.

When tacking or basting is necessary to help achieve the desired result, then it is worthwhile.

Experienced dressmakers can, and do, save much time by pinbasting the simpler, more straightforward seamings.

Dressmakers in such a hurry that they haven't time to trim edges are sacrificing the professional finish.

For example, trimming the seam allowance of a curved collar, and clipping out small wedges around the curve to avoid lumpiness, save time in turning the collar.

A more even and flatter edge also results.

Where time is short it is better to select fabrics, or styles, that require little or no trimming.

Buttons, provided they are washable, can provide a quick and effective trimming—alternatively, accessories can take the place of time-consuming applied trimmings.

For children's wear flat trimmings, such as embroidered braids, are quick and easy to attach and are easy to iron.

Novelty embroidery stitches and simple, quick-to-make trims that give a professional look to an otherwise uninteresting garment may be made by modern machines and attachments.

For mothers of a young family this type of machine is a worthwhile investment.

—From N.S.W. Agriculture Department's "Press Copy"

What You Should Know About Electric Drills

The connection between a portable electric drill and the source of supply is made by means of 3 or 4 core rubber or thermoplastic sheathed flexible cord, one being the earthing conductor.

The earthing conductor is distinguishable by its GREEN-coloured insulating covering. This earthing conductor is connected to the frame of the electric tool at a suitable terminal. Its purpose is to convey fault current to earth, and thus operate the protective device such as a fuse or circuit-breaker at the switchboard. This obviates any possibility of the frame of the drill becoming alive, and the operator being exposed to the risk of receiving a severe electric shock.

A Regular Check Is Essential

It is most important that drills and other electric tools be inspected regularly to ensure that they are maintained in a safe condition. Unless a check is made at regular intervals and repairs effected, the flexible cord attached to an electric drill will deteriorate, and break down electrically many times during the life of the drill.

Because of excessive flexing of the conductors during use of a portable electric drill, a common defect which occurs in flexible cords attached to electric drills is the breaking of conductors within their insulating sheathing. If any of the current-carrying conductors happens to break the operator knows of the defect by the drill not working. If, however, the earthing conductor becomes broken, whilst the current-carrying conductors of the flexible cord remain intact, there is no warning whatsoever to the operator until such time as a fault develops on the drill, causing the frame to become alive. In this case the operator would receive a severe electric shock if working on an earthed floor.

It is therefore clear that the flexible cord attached to the electric drill should be given the same attention and care as the drill itself. When the drill requires mechanical attention it lets the operator know. As the flexible cord is unable to do this, the importance of inspections at regular intervals cannot be too strongly emphasised.

Do's and Don'ts

To obviate risk of electric shocks, which may result in fatalities, the following simple precautions should be followed by all operators of electric drills:—

(*a*) DO NOT use a portable electric drill which is not connected with an earthing conductor, or if there is not a proper power outlet installed from which to take supply. On no account use a portable electric drill from a lampholder.

(*b*) DO NOT use a portable electric drill in which you have noticed any deterioration in the flexible cord until repairs have been effected by a certified electrical worker. DO NOT attempt to effect any electrical repairs yourself.

(*c*) DO NOT apply any undue stress on flexible cord attached to electric drill or other portable electric tool (for example, dragging or lifting drill by means of flexible cord).

(*d*) DO NOT leave flexible cord, when in use, in places where there is any likelihood of damage being caused to the insulation of cord.

(*e*) TAKE the added precaution of standing on a dry wooden platform or rubber mat when using a portable electric drill on a concrete or earthen floor.

(*f*) REGARD the portable electric drill and flexible cord as your own property and make sure regular inspections are carried out on the electrical connections by a competent person, to ensure particularly that the earthing conductor is efficient.

(*g*) TAKE CARE to keep cords clear of oil and grease when in use.

(*h*) HANG flexible cords in a safe place to avoid mechanical damage when electric drill is not in use.

(*i*) MAKE SURE that an approved type of cord connector is used when extension of flexible cord is necessary. Also see that both flexible cords incorporate an unbroken earthing conductor, correctly connected to the earthing terminals.

(*j*) NOTE that on some types of old electric drills live metal (for example, commutators) is exposed to personal contact. When using such apparatus, make sure that personal contact is not made with such exposed metal whilst flexible cord is connected to power outlet. Steps should be taken to have any aperture through which live metal is exposed to personal contact fitted with a protective covering.

(*k*) INSPECTION AND MAINTENANCE: To ensure that all accessories are mantained in a safe and serviceable condition, a visual inspection of the drill, followed by an insulation resistance test, should be made at least once every 12 months, and flexible cords, etc., should be inspected at least monthly by a competent electrician.

—*State Electricity Commission.*

* * *

Brian Pastures Field Day

Many Interested Women Were Included in the Big Audience Attracted to "Question Time" at the Brian Pastures Field Day in April.

Spark Arrester For International AW-7

Tested for International Harvester Co. of Australia Pty. Ltd.

Formal tests on spark arresters are conducted by The Tractor Testing Committee at the Testing Station, Werribee, on behalf of those Companies concerned with tractors, engines or spark arresters who wish to have these equipments tested. The arrester is tested on the engine it is specially designed for (as in this instance), or if it is sold for use on any or several engines, it is tested on an engine of the highest power for which the spark arrester is intended.*

1. Test Procedure

The method of test is based on a procedure standardised by the Society of Automotive Engineers (U.S.A.). This consists of feeding a weighed quantity of carbon particles of given size into the exhaust of the working engine, and then catching in a trap, and weighing, the particles that the arrester allows to pass through. Separate runs are conducted with particles of larger and smaller size; in some runs the engine is working at full load, in others at fast idle under no load.

According to the S.A.E. standard, no particles of the larger size should escape the arrester, and not more than 10 per cent. of the smaller size. At the same time the extra back pressure imposed on the exhaust system by the presence of the arrester should be no more than 10 in. in a water barometer.

2. Name and Type of Arrester: “AW-7” (I.H.C. Part No. 843846R91).

Submitted by: International Harvester Co. of Australia Pty. Ltd., Geelong, Victoria.

For Particular Tractor: International AW-7 Diesel.

3. Brief Specification of Arrester

Operating Principle: Perforated screen.

Declared Maximum Horse-Power: Not stated (nominally 50 shaft h.p.).

Dimensions: Exhaust pipe.: dia.—2⅜ in.; Tail pipe: dia.—2½ in., length—5¼ in. Arrester: outside dia.—5¼ in.; length—9½ in.; weight—6½ lb.

Materials: Mainly 16-gauge steel. Screen—26-gauge perforated stainless steel.

Mounting: Vertical, ahead of operator, effluent upwards.

Details of Test Engine: International AW-7 Tractor. 4-cyl. diesel 47 belt horse-power maximum; 264 cu. in.; rated speed, 1,450 r.p.m.

4. Summary of Test Results

(Particles injected at rate of 100 gms. in 18-20 minutes.)

(*a*) *Effectiveness of Spark Arresting:*—

Particle Size	Engine Load Condition	Carbon Passing Arrester (Percentage)	Remarks
Large . .	High . .	Nil	Two tests
Large . .	Low . .	Nil	Two tests
Small . .	High . .	1·0	Average of two tests
Small . .	Low . .	0·5	Average of two tests

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* The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders-lane, Melbourne.

(*b*) *Back Pressure:* At High Load, 4½ in. water.

(*c*) *Temperatures:* Not taken.

(*d*) *Noise Levels:* Not taken.

5. Comment

(*a*) *Risk of Bad Fitting through Damage:* The two sheet-metal ends fit over the sheet-metal shell: if the fitting at the lower (inlet) end is imperfect, for example, through denting by damage, then unscreened carbon particles could escape.

(*b*) *Screen Openings and Material:* The screen consists of perforated 26-gauge stainless-steel sheet. Overseas tests suggest that burning of carbon particles which may become caught in the screen leads to rapid failure unless the screen is made of nickel-chromium alloys.

Compared with iron-wire screens, the use of stainless steel in the form of perforated sheet would be expected to give a longer life.

(*c*) *Prospective Life:* It is impossible to estimate the probable life of the screen; it is, however, easily replaced, and the makers expect it to be regularly inspected, and to be renewed as required.

Subsequent tests for 1,000 hours at full load, reported by the applicant company, suggest that the stainless-steel screen is virtually unimpaired after such service, and that it is likely to outlast the sell.

NOTE.—This report makes no promise about the likely performance of the arrester other than in the condition supplied for test, that is, new.

University of Melbourne, August 1, 1958.

W. F. Baillie,
Testing Officer.

G. H. Vasey,
Officer-in-Charge,
Tractor Testing.

* * *

Sheep And Wool Handling School

The Pilot Sheep and Wool Handling School established at the Royal Melbourne Showgrounds was described as the Nucleus of a National Institution by the Victorian Minister for Agriculture (Mr. G. L. Chandler). He was opening the first of a nation-wide series of schools that would be developed by the Australian Wool Bureau. He said that the schools would play a vital and necessary role in the Australian wool industry's fight against rising costs and lower returns. The aim of it, and the others to be set up, would be increased efficiency in woolshed management.

Chamberlain Spark Arresters

Formal tests on spark arresters are conducted by The Tractor Testing Committee at the Testing Station, Werribee, on behalf of those companies concerned with tractors, engines or spark arresters who wish to have these equipments tested. The arrester is tested on the engine for which it is especially designed or if this is not convenient it is tested on an engine having the characteristics and power for which the spark arrester is intended.*

Chamberlain Champion

Name and Type.—Chamberlain Champion.

Submitted by.—Chamberlain Industries Pty. Ltd., Welshpool, W.A.

For Particular Engine.—Chamberlain Champion Tractor.

Brief Specification of Arrester

Operating Principle.—Centrifugal separator.

Declared Maximum Horse-power.—Not stated.

Dimensions.—Exhaust pipe, diameter 2½ in. Tail pipe, diameter 2½ in., length 5 in. Arrester, outside diameter 7 in., length 14½ in., weight 10 lb.

Materials.—Body—16g. M.S.; Swirling vane element—C.I.

Summary of Test Results

(*a*) *Effectiveness of Spark Arresting.*—Particles injected at rate of 100 gm. in 15 min.

Mounting.—Vertical, ahead of operator, effluent upwards.

Details of Test Engine.—Perkins L4 Diesel in Chamberlain Champion Tractor; 4 cyl.; 270 cu. in.; 46 horse-power max.; rated speed 2,000 r.p.m.

Particle Size	Engine Load Condition	Carbon Passing Arrester (Percentage)	Remarks
Large . .	High	0·1	Average of two tests
Large . .	Low	Nil	Two tests
Small . .	High	0·4	Average of two tests
Small . .	Low	Nil	Two tests

(*b*) *Back Pressure.*—At high load 10 in. water.

(*c*) *Temperatures.*—Air—58 deg. F.; Body of Arrester—approx. 750 deg. F.

(*d*) *Noise Levels.*—Not taken.

Comment

(*a*) The arrester tested was a prototype incorporating changes arrived at by an earlier series of trials. Chamberlain Industries Pty. Ltd. have advised that the design here reported on will become the stock model for all future production.

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* The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders Lane, Melbourne.

(*b*) *Cleaning plug.*—A brass, rather than a C.I. plug or cap, would be desirable in this situation; the C.I. plug is likely to become difficult or impossible to remove, leading to the neglect of any recommended cleaning routine.

(*c*) *Life.*—The arrester is of the type not able to be dismantled for inspecting and replacing the internal elements. According to the S.A.E. specification, its expected life, therefore, should be equal to the life of the engine for which it is intended. The arrester seems likely to be able to meet this requirement.

(*d*) This report makes no promise about the likely performance of the arrester other than in the new condition in which it was supplied for test.

Chamberlain Countryman

Name and Type.—Chamberlain Countryman.

Submitted by.—Chamberlain Industries Pty. Ltd., Welshpool, Western Australia.
For Particular Engine.—Chamberlain Countryman Tractor.

Brief Specification of Arrester

Operating Principle.—Centrifugal separator.

Declared Maximum Horse Power.—Not stated.

Dimensions.—Exhaust pipe, diameter 2½ in. Tail pipe, diameter 2½ in., length 5 in. Arrester, outside diameter 7¼ in., length 16 in., weight 12 lb.

Materials.—Body—16 g. Steel; Swirling vane element—Cast Iron.

Mounting.—Vertical, ahead of operator, effluent upwards.

Details of Test Engine.—Meadows Diesel in Chamberlain Countryman Tractor; 4 cyl.; 67 Horsepower max.; 330 cu. in.; rated speed 1,800 r.p.m.

Summary of Test Results

(*a*) *Effectiveness of Spark Arresting.*—Particles injected at rate of 100 gm. in 15 min.

Particle Size	Engine Load Condition	Carbon Passing Arrester (Percentage)	Remarks
Large ..	High	0·1	Average of two tests
Large ..	Low	Nil	Two tests
Small ..	High	0·2	Average of two tests
Small ..	Low	0·1	Average of two tests

(*b*) *Back Pressure.*—At high load 6½ in. water.

(*c*) *Temperatures (°F).*—Air 58 deg. F. Body of arrester 750 deg. F. approx.

(*d*) *Noise Levels.*—Not taken.

Comments

(*a*) The arrester tested was a prototype incorporating changes arrived at by an earlier series of trials. Chamberlain Industries Pty. Ltd. have advised that the design here reported on will become the stock model for all future production.

(*b*) *Cleaning plug.*—A brass, rather than a C.I. plug would be desirable in this situation; the C.I. plug is likely to become difficult or impossible to remove, leading to neglect of any recommended cleaning routine.

Life.—The arrester is of the type not able to be dismantled for inspecting and replacing the internal elements. According to the S.A.E. specification, therefore, its expected life should be equal to the life of the engine for which it is intended. The arrester seems likely to be able to meet this requirement.

(*d*) This report makes no promise about the likely performance of the arrester other than in the new condition in which it was supplied for test.

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Plate 1: **Prime Yearling Beef in the Making in the Feed Lot at "Arcturus Downs," on the Central Highlands.**

The Basis Of Cattle Feeding

By W. F. MAWSON, Senior Adviser in Cattle Husbandry.

The methods of production in both the dairy and beef industries are in the process of change. This may not be so obvious when viewed over 1 year but if comparisons are made over a 10-year period definite trends are apparent.

In the case of the dairy industry there have not been great changes in the volume of production. The main change has been in the use of dairy products, with increasing emphasis on the liquid milk trade and its associated products. This can be seen clearly in figures published by the Commonwealth Bureau of Census and Statistics. A comparison is made between the average of 10 years, 1947 to 1956, and the financial year, 1958-59.

The liquid milk includes milk sold as liquid milk, sweet cream, ice cream and all other purposes in addition to milk used in the production

TABLE 1

MILK PRODUCTION AND USE IN QUEENSLAND

Average of 10 years	Total Milk Production (gal.)	Used for Making Butter (gal.)	Used for Making Cheese (gal.)	Liquid Milk and Other (gal.)	Percentage Used as Liquid and Other
1947–56	259,904,000	199,766,000	17,914,000	41,414,000	15·98%
1958–59*	258,814,000	185,001,000	18,625,000	55,188,000	21·32%

* Subject to revision.

of condensed and powdered milk and other milk products. Figures are not presented to indicate the amounts used for each of the separate categories. The total amount used for these categories are obtained by subtraction and are referred to, for convenience, as liquid milk.

It is interesting to note that total production in 1958-59 shows little change from the average for the 10 years, 1947-56. However, the proportion used in the liquid milk trade has increased by more than 5 per cent., representing an additional 13,700,000 gal. a year. The increase in use of liquid milk in 1958-59 compared with the previous 10-year average is of the order of 33.4 per cent.

This increasing use of dairy products as liquid milk has important implications for the producer. A deal of cost and effort has been expended in developing the liquid milk market. To hold this market it is vital that adequate supplies of milk are always available. This is in marked contrast to butter production which has a distinct seasonal pattern.

In order to achieve steady production throughout the year the dairyman who is catering for the liquid milk trade has to maintain a high plane of nutrition for his herd throughout the year. Except for very isolated areas, or in particularly favourable years, this is not commonly achieved by relying entirely on improved or irrigated pastures. In many cases some form of fodder will have to be conserved or purchased and used to level out the plane of nutrition. If this is to be done economically, the farmer requires a sound knowledge of the feed requirements of his cows. Correct decisions on these matters will not be made unless the farmer is familiar with the needs of the particular type of animal, the foodstuff value of the basic ration, the type of foodstuff required to supplement the basic ration and the most economical form in which to supply the necessary supplement. In short, he needs a sound knowledge of the principles of dairy cow nutrition.

Plate 2

These Friesian Springers on the Darling Downs Are Set for Profitable Lactations.

Beef Cattle

In the beef industry, total meat production in Queensland has shown a remarkable increase. This is indicated by figures taken from the annual report of the Australian Meat Board for the year ending June 30, 1959. Averages of 5 years' production at 10-yearly intervals are compared in order to avoid distortion brought about by drought years. Production figures are carcass weight of all cattle (including calves) killed for human consumption, excluding edible offal.

For the 5 years, 1945-1949, the average yearly production of beef and veal was 186,340 tons. Ten years later, that is for the 5 years 1955-1959*, the average had risen to 296,080 tons, an increase of 109,740 tons a year which is approximately 59 per cent.

The average beef cattle populations for the corresponding periods were 4,800,000 and 5,880,000 head respectively. This is an increase of 1,080,000 head or 22.5 per cent.

Thus, not only has there been a spectacular rise in total production but there has also been an intensification of production. Production has been speeded up with a greater weight of beef produced in a given time.

To do this more fodder has to be used—and by younger animals. The quality of the fodder has been improved by using improved pastures and crop. Supplementary and drought feeding of range cattle has commenced and feed lot fattening is being undertaken by some producers.

If he is to keep up with these modern trends, the producer is forced to learn more about the feeding of his animals. Just how much of a subject such as animal nutrition should a producer know? The application of basic principles of animal nutrition will enable him to obtain a higher level of efficiency of use of feeds for

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* The figures for 1959 are subject to revision but such revision could have only a slight effect on the 5-year average.

Plate 3

A Substantial Supply of Surface Water on Grazing Land at "Evergreen," in the Rockhampton District.

production of beef or milk. These basic principles which the up-to-date producer should grasp are presented here as plainly as possible. Reference is made to dairy and beef cattle only, and this fact should be kept clearly in mind. The term "bovine" is used to denote cattle—thus "bovine nutrition" refers to the feeding of cattle as distinct from "animal nutrition" which includes all other animals in addition to cattle.

Types of Rations

What do we mean by the word "ration?" Simply this—"the quantity of foodstuff which the animal is offered or can obtain in a period of 24 hours." This tells very little about its effect on the animal unless the quality of the foodstuff and the amount which the animal will eat are known. As a matter of convenience in computing rations, it is useful to make a somewhat artificial division of a ration. Thus the terms "maintenance component" and "production component" are used.

A "maintenance" ration supplies just enough feed to maintain an animal for 24 hours without any loss or gain in weight and without any production.

The "production" ration is that part over and above the "maintenance" ration which is used for production—in this case, milk or beef. It will be noted later that in the case of breeding animals, an allowance for reproduction is required for the last 2 to 3 months of pregnancy.

If animals always had as much feed of the right quality as they could eat, there would be no need to concern ourselves with maintenance and production rations. However, that is not the case, nor is it likely to occur on a large scale.

The urge to survive is strong in animals, hence the maintenance requirements have first call on the foodstuff consumed. But the maintenance needs are not fully met before there is some production. The dairy cow is able to produce some milk on a below-maintenance ration by drawing on her body reserves of fat and muscle. Of course, this cannot continue indefinitely. When all the body reserves of the animal are used up, it becomes weak and death occurs unless the ration is improved. The beef cow nursing a young calf will use her body reserves for the purpose of milk production, but to a lesser degree.

If the total ration is not ample in either quantity or quality for the current rate of production there will be a loss of weight as body reserves are used. Under most circumstances a decrease in the weight of an animal indicates that the ration being fed is inadequate. An exception is the case of cows in the first 2 months or so after calving when weight loss occurs even though the ration is adequate. Failure to make weight gains on the part of young, growing animals also points to an inadequate ration, unless disease or parasites are responsible for some interference with the use of the ration.

During the first 6 to 10 weeks of lactation it is natural for a good dairy cow to use some of her body reserves of fat, muscle and minerals for milk production. Under these circumstances such a cow could be on a high plane of nutrition and still be losing bodyweight. The extent to which the freshly-calved cow changes her body reserves to milk production depends in part on the size of the reserves. If we use the term "condition" to mean the state of fat and muscle accumulation then a cow in good condition is one with sizable reserves. Experienced producers can gauge this from the appearance of the stock. The stored fat and muscle adds weight to the animal, so bodyweight is the best measure of it for individual animals. There is need for caution in obtaining the weight of pregnant animals. The developing foetus and accompanying fluids add appreciable weight from the sixth month of pregnancy onwards. As an approximation, the weight of fluid and membranes at birth can be regarded as equal to the weight of the calf. The combined weight at birth is likely to range from 100 to 180 lb. depending on the size of the cow.

The Parts of a Foodstuff

In order to understand the quality of various feedstuffs a little more fully, it is necessary to consider them in their various parts. We can then appreciate the particular values of feeds and compare them on the basis of their feeding value. The chemical composition of a foodstuff gives basic information on the likely value and we shall now consider the components as shown by a chemical analysis:

1. *Dry Matter.*—Dry matter is expressed as a percentage of the feed. It is alternatively named as "moisture-free" or "water-free" material. The remainder of the foodstuff consists of water or moisture. Analyses of plant material in Queensland are expressed usually on a "dry matter" basis.

Young, lush, irrigated pasture may contain 10 per cent. dry matter and 90 per cent. water for example, while a pasture just before flowering may consist of 25 per cent. dry matter and 75 per cent. moisture. In rationing, the water intake of animals is considered separately as only the dry matter contains the food nutrients. A cow eating 100 lb. of a pasture containing 75 per cent moisture would be receiving 25 lb. of dry matter

Cutting and drying in the air will reduce the water content of a foodstuff. Thus, grass containing 75 per cent. moisture becomes hay with a moisture content of about 10 per cent. Air drying reduces the moisture content to about 10 per cent. and some rationing standards are now based on "air-dried feed containing 90 per cent. dry matter." Oven drying of the material is necessary in order to arrive at total dry matter

In comparing feeds, the content of various food components should be reduced to a dry matter basis for each feed. For instance, it is not reasonable to compare 1 lb. of silage with 1 lb. of hay since the silage contains 70 to 80 per cent. of water and the hay about 10 per cent. of water. Water is necessary for stock but it does not have to be provided in the foodstuff when it is available as drinking water.

2. *Crude Protein.*—Since it is known that proteins used in animal feeding contain approximately 16 per cent. of nitrogen, the crude protein content is calculated from the nitrogen content as determined by chemical analyses The nitrogen determination includes a small percentage of nitrogenous substances such as urea which are not strictly proteins. However ruminants are able to make use of these substances in limited quantities.

Plate 4

Portion of the Breeding Herd on "Comet Downs" in the Central Highlands. Some of these calves will be fattened in the feed lot at "Arcturus Downs", in the same area.

Its nitrogen content is the distinctive feature of protein, which also consists of the elements carbon, hydrogen and oxygen plus various minerals.

3. *Crude Fat.*—In addition to fat this fraction contains resins, gums and oil. Fat is a combination of carbon, hydrogen and oxygen.

4. *Crude Fibre.*—This comprises generally the outer coverings of plants as well as the woodier sections. Fibre also consists of a combination of carbon, hydrogen and oxygen but in different proportions from that in fat.

5. *Carbohydrates* or "nitrogen-free extract" also comprise carbon, hydrogen and oxygen which are generally in a more soluble and digestible form compared with fibre.

6. *Ash.*—This is mineral matter, which includes sand and other material not dispersed by heat. An analysis of the ash content is made for the two major mineral elements in bovine nutrition, namely phosphorus and calcium. These are expressed as percentages of phosphoric (P_2O_5) acid and quicklime (CaO) respectively.

7. *Vitamins.*—Vitamins are the other important group of substances in fodders but are not determined in an analysis of the type mentioned.

It is not proposed to consider minerals and vitamins further. Quite a number of minerals and vitamins are known to be essential to bovine health and production but they can be dealt with conveniently in a separate section without interfering with rationing principles. In many cases a ration that is adequate in other respects will also be satisfactory for minerals and for vitamins.

The crude protein, crude fat, crude fibre and carbohydrate are all expressed as percentages of the total. If the analysis is on a "dry matter" basis (which is most likely in Queensland) then the percentages will relate to the total dry matter in the foodstuff.

Assessing the Value of a Foodstuff

It would be obviously a cumbersome system if one had to consider a foodstuff in terms of crude protein, crude fat, crude fibre and carbohydrate. You will recall the statement that the nitrogen content was the factor which gave protein its particular value. Further, the fat, fibre and carbohydrate portions all consisted of different combinations of the same elements—carbon, hydrogen and oxygen.

These are in the form of sugars, starch and cellulose. The cellulose is the fibrous portion.

You will note the use of the term "crude". This means that some of the material, because of its indigestible nature, will be of no use to the animal. Without explanation at this stage we shall jump from the idea of "crude" to "digestible" in order to show how the value of foodstuffs is measured.

Several different terms are used but the two most common ones will be explained. The term *"total digestible* nutrients" (abbreviation T.D.N.) is widely used in America to sum up the total value of a feed. It is the sum of the digestible portions of the protein, fat fibre and carbohydrate expressed as a percentage. Fat is multiplied by a factor (2.3) before inclusion, in order to allow for its greater energy value per lb. The T.D.N. content can be regarded as the gross energy value of a foodstuff. While the protein, fat, fibre and carbohydrate which together comprise T.D.N. are termed "digestible", certain losses (which will be referred to later) do occur.

The English system of *"Starch Equivalent"* (S.E.) tries to overcome this by comparing the foodstuff in question with starch, which is regarded as being totally digestible. This also is expressed on a percentage basis in that if 100 lb. of the foodstuff were equivalent in feeding value to 70 lb. of starch then the foodstuff would have a starch equivalent of 70.

When feeds such as protein rich meals are being considered there is not a great deal of difference between the T.D.N. and S.E. values because such meals are highly digestible. However, in the case of fibrous feeds such as straw, in which losses in digestion are high, there is a big difference between the T.D.N. and S.E. values. The important point to remember is that T.D.N. and S.E. are indicators of the energy value of a foodstuff.

Since protein is such an important part of a ration and a shortage of it lowers the value of an otherwise adequate ration, the protein fraction is stated separately. Again, look for digestible protein, rather than crude protein. The crude protein content of prepared meals appears on a label attached to each bag. The percentage digestibility of the crude protein in most protein-rich meals is of a high order and can be expected to be in the region of 80 per cent. In the case of plant material, the digestibility of the crude protein declines as the protein content falls. This results in a double-barrelled, unfavourable effect from a nutritional viewpoint. The protein value of feedstuffs which is most commonly used is the *"digestible protein"* (abbreviation D.P.) content on a percentage basis. Animal requirements are expressed in terms of digestible protein.

How the Animal Uses Energy and Protein

So far, we have seen the main divisions into which a foodstuff can be divided for purposes of determining its chemical composition. Further the way in which these fractions are combined to give a working basic for comparison and calculation is shown. Now we shall consider the special part or function which both energy (expressed as T.D.N.) and protein (expressed as digestible protein) have in cattle feeding.

T.D.N. or S.E. is indicative of the energy value of a foodstuff. Energy is the fuel for the animal body. The T.D.N. portion provides the energy for movement, digestive processes, breathing and all activity. Surplus energy is stored as fat.

Protein is required for purposes of growing, repair and production. It is an essential part of muscle (or lean meat) internal organs, cartilage and connective tissues and parts such as skin and hair. Milk is rich in protein, which comprises about one-quarter of the total solids in this food. The millions of cells which are combined to make up an animal body consist largely of protein. You will realise how vital is an ample supply of protein to the young, growing animals or one engaged in high milk production. Surplus protein can be stored as muscle.

Protein consists of a collection of simpler substances known as amino acids. The number of amnio acids present in a particular protein determine its quality but this need not concern us except in the case of feeding young calves on a ration other than milk.

The importance of water should not be overlooked. It is the largest single part of nearly all

Plate 5

Two and Three Year Old Herefords Fattening on Oats at "Wealwandangie", in the Central Highlands.

living animal tissues. Muscles and internal organs contain 75 per cent. or more. Normal milk contains about 87 per cent. water. Water can assist in regulating body temperature and plays a part in the digestion of food materials. Blood contains 91 per cent. water.

The Effect of Shortages in Rations

When his stock are not thriving the keen producer will want to know why. Without knowing the cause it is not possible to consider the practicability of applying the remedy.

Healthy stock, well-cared for, and in a favourable climate should produce according to their inherited capacity if the ration is ample in both quantity and quality. By quantity is meant the amount actually eaten by the animal, while quality refers to the level of T.D.N. and D.P. plus the factors of palatability and digestibility.

Under pastoral conditions, and even with a considerable amount of cropping and fodder conservation, there are often periods when the ration is inadequate for the immediate needs of animals. When available, cattle can use their stored reserves of fat and muscle for either maintenance or production. This state of affairs cannot continue indefinitely, however, as the reserves become exhausted. But like any other reserve, it is important to know when is the least unfavourable time for the animal to use them and for how long can they be used without causing serious economic loss.

What are the effects of a shortage of either T.D.N. or D.P. in the ration? The most common situation is where there is a shortage of both, and animals have a reduced growth rate, rough hair coat and general unthriftiness. There is loss of body weight and production and in addition animals are inclined to eat plants and items such as bark which they would not touch if they were well fed. Deaths from poison plants are common under these circumstances.

A shortage of protein, even if T.D.N. are ample, will result in poor development, depressed appetite, unthriftiness and loss of weight in the case of young, growing animals. In dairy cows there is a drop in milk production, even though bodyweight may be increasing. In other words, the cows may look well but be producing at a low level.

A lack of T.D.N. will result in a slowing down in growth rate and/or fattening rate of beef cattle. Dairy cattle on a ration ample in protein but lacking T.D.N. will probably maintain milk production for a time but lose bodyweight. A prolonged lack of T.D.N. will result in lowered production.

One point should be noted. Animals are able to use surplus protein in the ration as a source of energy. However, a surplus of feed high in energy cannot be used by the animal to replace protein.

The Requirements of Animals

Animal requirements for Dry Matter, T.D.N. and D.P. are available in tables from various sources. Those for fattening beef cattle appear in the *Queensland Agricultural Journal* for January, 1960.

The following allowances for selected classes of beef cattle are taken from a National Research Council publication Number IV, "Recommended Nutrient Allowances for Beef Cattle" (1950):

TABLE 2

Daily Nutrient Allowances for Beef Cattle
(Based on feed containing 90% Dry Matter)

Body Weight (lb.)	Expected Daily Gain (lb.)	Total Feed		D.P. (lb.)	T.D.N. (lb.)	% Required in Ration	
		% of Live Weight	Per Animal (lb.)			D.P.	T.D.N.
(*a*) Normal Growth, Heifers and Steers—							
400	1·6	3·0	12	0·9	7·0	7·5	58
600	1·4	2·7	16	0·9	8·5	5·6	53
800	1·2	2·4	19	0·9	9·5	4·7	50
(*b*) Wintering Weaner Calves—							
400	1·0	2·8	11	0·7	6·0	6·4	55
500	1·0	2·6	13	0·8	7·0	6·2	54
600	1·0	2·5	15	0·8	8·0	5·3	53
(*c*) Wintering Pregnant Heifers (weights are for beginning of winter period; gains average for period)—							
700	1·5	2·9	20	0·9	10·0	4·5	50
800	1·3	2·3	20	0·9	10·0	4·5	50
900	0·8	2·0	18	0·8	9·0	4·5	50
(*d*) Cows Nursing Calves, 1st 3–4 Months After Parturition—							
900–1,100	Nil	. .	28	1·4	14·0	5·0	50

Of importance to producers under our conditions is the fact that maintenance allowances as shown are for animals maintained in stalls or loose boxes. The T.D.N. or energy requirements for maintenance of grazing animals are possibly 40 to 60 per cent. higher.

TABLE 3

Nutrient Allowances for Dairy Cattle*
(Based on air-dry feed containing 90 per cent. dry matter)

Body Weight (lb.)	Daily Gain		Daily Requirements			Percentage Required in Ration	
	Small Breeds (lb.)	Large Breeds (lb.)	Feed (lb.)	D.P. (lb.)	T.D.N. (lb.)	D.P.	T.D.N.
(*a*) Normal Growth of Dairy Heifers —							
50	0·5	. .	0·9	0·20	1·0	22	110
100	1·0	0·8	2·0	0·40	2·0	20	100
150	1·3	1·4	4·0	0·50	3·0	12·5	75
200	1·4	1·6	6·0	0·60	4·0	10·0	67
400	1·2	1·8	11·0	0·80	6·5	7·3	59
600	0·8	1·4	15·0	0·85	8·5	5·7	57
(*b*) Maintenance of Mature Cows —							
800	. .	. .	12·0	0·50	5·8	3·6	50
1,000	. .	. .	14·0	0·60	7·0	3·7	50
1,200	. .	. .	16·0	0·70	8·2	3·9	50
1,400	. .	. .	19·0	0·80	9·4	3·8	50
(*c*) Reproduction (add to maintenance during last 2 to 3 months)—							
. .	2·0	2·0	8·0	0·60	6·0	6·5	60
(*d*) Lactation (add to maintenance for each gallon of milk) —							
. .	. .	3% fat	. .	0·40	2·8	. .	. .
. .	. .	4% fat	. .	0·45	3·2	. .	. .
. .	. .	5% fat	. .	0·50	3·7	. .	. .
. .	. .	6% fat	. .	0·55	4·2	. .	. .
(*e*) Maintenance of Breeding Bulls —							
1,200	. .	. .	18	1·00	10·3	5·6	. .
1,600	. .	. .	22	1·20	12·9	5·5	. .
2,000	. .	. .	27	1·45	15·6	5·4	. .

* From National Research Council Publication (1956) 464 No. III Nutrient Requirements of Dairy Cattle.

Expressing the Value of Feeds

Average values for common feeding materials are expressed in terms of dry matter, crude or digestible protein, total digestible nutrients or starch equivalent and content of phosphorus and calcium. The likely vitamin content is usually stated separately.

The values of feeds commonly used appear in the *Queensland Agricultural Journal* for July, 1959, pages 434-435, and January, 1960, pages 9-10.

Food Value of Plants

When considering the feeding value of growing plant material it should be recognised that the figures are best regarded as a "working guide".

The reason for this is in the changing composition of the plant as it grows and matures and in the grazing habits of the animals. It is worthwhile considering some of the factors which have to be taken into account when assessing the value of growing plant material.

1. *Composition Changes.*—The most valuable parts of plants from a feeding point of view are the leaves; the proportion of leaves to stalk is highest in the young growing stage. As plants mature, the protein content falls—often rapidly—and the fibre content rises. Quite an amount of the energy and mineral content is concentrated n the seed of the plant. When the seed drops, the plant becomes standing straw of very low food value. Summer-growing plants are badly affected by frost which destroys the feeding value of the leaves and lessens the food value of the stalks.

2. *Grazing Habits of Animals.*—When plants are in the growing stage animals will eat to capacity. An exception is the case of some of the ropical legumes and summer legumes such as cow-pea which are comparatively unattractive to stock in the young growing stage. As plants reach the flowering stage, many become somewhat repulsive to the grazing animal because of the development of hairs and awns. This characteristic is intensified as the plants proceed to the seeding stage. The animal reacts by grazing selectively. It avoids the flowering parts of the plants and strips off the leaves. If possible, it avoids the flowering plant in favour of others which are not flowering because of previous grazing or because they have a different cycle of growth. This illustrates the difficulty associated with obtaining a representative sample of what a grazing animal is eating.

Selective grazing also occurs when different species of plants are available to animals and also when some local factor, such as the presence of a dung pad, contaminates an area.

3. *The Particular Feeding Value of Legumes.*—Legumes as a group of plants are rich in protein. The decline which occurs in protein content as the plant matures is much less in the case of legumes than in the case of grasses. For this reason hay made from a legume has a considerably higher protein value than hay made from a grass under comparable circumstances. Thus lucerne hay is of much greater value as a source of protein than oaten or wheaten hay. Annual legumes which are relatively unattractive to stock in the growing stage and then retain their feeding value as standing hay are especially valuable in the grazing industry. Such a one is Townsville lucerne.

The Digestive System of Cattle

A good deal of mention has been made of digestibility and digestible nutrients. Now we will consider in a little more detail the actual digestive system of cattle. It is this particular system which enables bovines to convert coarse roughages which are unsuitable as food for humans into

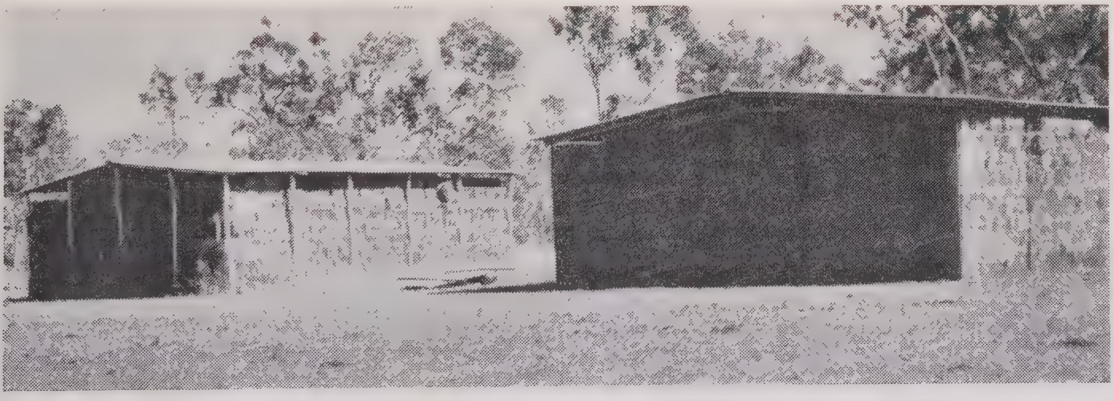

Plate 6

Fodder Conservation at "Laudham Park" in the Townsville District. Each shed is 40 ft. long, 36 ft. wide and 12 ft. high, and about 100 tons of baled Townsville lucerne and mixed grass hay were stored when this photograph was taken.

foods of the highest quality for human consumption in the form of meat and milk and its products.

The process of digestion consists of the gathering of food, breaking it down into simpler substances which can be absorbed into the blood stream, the assembly and transportation of nutrients to the required areas and the rejection of unused or waste materials. It is with the "breaking-down" process that we are concerned.

In single-stomached animals such as the horse and pig, the chewing of these animals starts the breaking down process. Chemical substances called "enzymes", and hydrochloric acid act on the food particles in the stomach and the upper part of the intestine to produce substances which can be absorbed.

The bovine differs from the single-stomached animal in that it chews its cud or ruminates (hence the term "ruminant" to describe animals with this characteristic) and has a four-compartment stomach. Enzyme and acid action do not occur in the first three compartments.

When food is gathered by cattle it is swallowed and lodges in the first compartment—the rumen or paunch. Here the food is mixed by muscular action. When regurgitated for chewing it is ground by the molar teeth at the back of the mouth and mixed with saliva. It has been estimated that a bullock produces about 13 gal. of saliva a day when fully ruminating.

The ground particles of feed are then re-swallowed into the rumen. At this stage the activity of the micro-organisms has its full effect. These micro-organisms hold the key to the digestion of coarse materials. They exist in well-nigh countless millions in the rumen when conditions are favourable. Several different groups are there, ranging from very simple organisms to others which are classed as "animals" in that they have the elements of a digestive system themselves. As a matter of convenience we shall refer to them conjointly as "bacterial".

These bacteria attack the food particles and break them down into the simpler substances which then pass on to the fourth stomach. The bacteria are also able to reduce fibrous material or cellulose, which is resistant to enzyme digestion, to a state where the enzymes are able to continue the digestive process. It has been estimated that 70 to 80 per cent. of the digestible dry matter disappears during its stay in the rumen. It remains in the rumen for 70–90 hours.

In the process of bacterial digestion in the rumen, gases are produced and heat is given off. The disposal of both gas and heat poses a problem for the animal. Gas is released by belching and if this does not occur a build-up of gas is likely to result in bloat. Heat which is given off in the rumen is an embarrassment to animals under tropical conditions. It can be used to keep up the body temperature under cold conditions but has a very limited value in this respect in the tropics where keeping body temperature down is often the major consideration. The digestion of very fibrous material demands high activity by the rumen bacteria and this results in increased heat production.

The study of rumen bacteria is proceeding all over the world and it is a subject about which a great deal is still to be learned. It is considered that the proportion of one type to another varies according to the ration of the animal. It is thought that one type of feed, say lucerne hay, encourages the development of a special type of of bacteria. On the other hand a ration consisting mainly of grain would lead to the development of a different type. This explains why changes in the composition of rations should be made gradually.

Multiplication of bacteria in the rumen proceeds rapidly under favourable conditions. The life cycle of a single member is very short. When the bacteria die they become a source of food—especially protein—to the animal. This partly explains why ruminants can use simple nitrogenous compounds such as urea. Bacteria are able to use the product of urea as a source of nitrogen for themselves. They change it to protein which then becomes available to the animal when the bacteria die.

In addition to the breaking down of fibre and providing some protein for the host animal, bacteria are able to manufacture certain vitamins in the rumen.

When a high proportion of the ration consists of fibrous material the matter of efficient bacterial digestion is of great importance. The more efficiently these bacteria can be kept busy the better is the animal able to use the coarse feed. The rate of passage of feed has an influence on its use. When scouring occurs the food passes through at a rate too fast to permit adequate absorption of nutrients. On the other hand the rate of passage of fibrous material will slow down if it is not sufficiently reduced in size in the rumen. An accumulation of fibrous material in he stomach results in a depression of appetite. Jnder these circumstances animals are not only orovided with fodder of poor quality but in addition suffer from a lack of appetite. This ituation is seen frequently in cattle grazing only on mature native grass.

When we have a preponderance of low quality ibrous feed for our stock—and that occurs every vinter for animals grazing native pastures—the iumber one aim should be to keep the ruminal oacteria working vigorously. They have their own particular nutrient requirements. Accordingly, it is essential that these requirements should oe provided in the ration for the animal. It is cnown that the bacteria have the following equirements:

(*a*) Energy, including small amounts of readily available energy such as sugars or starches.
(*b*) Ammonia-bearing ingredients such as protein or urea.
(*c*) Major minerals, especially sodium, potassium and phosphorus.
(*d*) Cobalt and possibly other trace minerals.
(*e*) Unidentified factors found in certain natural feeds rich in protein or non-protein nitrogenous constituents.

Any person concerned with the feeding of attle cannot afford to ignore the needs and ctivities of the bacteria working in the rumen.

Digestibility

Now, briefly to return to the term "total digestible nutrients". This was stated to be a measure of the energy value of a feed, excluding the undigested portion which passes through in the dung. In the process of digestion there are further losses, of which mention is made. Small losses occur in the form of gases which escape and are not absorbed by the animal. Of the nutrients absorbed there is a loss of nitrogenous matter which is excreted in the urine.

The "work of digestion" or the heat which is given off in the process of digestion in the rumen is a further source of loss of energy. This loss can be very high in the case of low quality fibrous materials and may well reach the stage where no net energy is available for use by the animal. In that case, all the energy has been lost as heat in the work of digestion.

The losses in good quality feeds of low or medium fibre content such as grains or good quality lucerne hay are not high. The "total digestible nutrient" value of feeds such as these bears a close relationship to the "net" or "digestible" energy, which is the measure of the quantity of a foodstuff which is actually used by the animal for purposes of maintenance and production.

Plate 7

The Steer in the Centre was Topping-Off on Oats at "Wealwandangie". He was less than two years of age but had an estimated dressed weight of over 700 lb. He was sired by a Hereford bull from a ½-cross Brahman cow. His name "Satellite" matched his soaring growth rate.

Tuberculosis-Free Cattle Herds

(As at 1st June, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, W. S. & Sons, "Brookland", Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Angel, W. D., "Summerhill", Murgon
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Green Panic-Lucerne Fills In The Fodder Gap

By R. G. WILSON, Adviser in Agriculture.

Plate 1: **Green Panic-Lucerne Pasture on Mr. L. Stark's Property at Thornville, via Wutul.** When the drought broke, this paddock gave 2 weeks' grazing before annual fodder crops had emerged from the soil.

The year 1960 will be remembered by many as a dry, lean one. Mr. Len. Stark, of Thornville, via Wutul, on the Oakey–Cooyar line, will remember it as a year that confirmed his opinion that established rain-grown green panic-lucerne pasture is hard to beat for dry weather toughness and rapid growth response.

Mr. Stark found that his improved pastures have helped immensely to fill in the non-productive periods between annual crops.

One of the most important factors was the rapid green feed responses that followed each rain.

Following the relief rain of last October, Mr. Stark's stock had secured two weeks' good grazing before Sudan grass seed sown on the same rain had emerged from the soil.

Like a number of other dairy farmers and stockmen, he had green feed before the Sudan grass was fit to graze.

Soil Erosion and Couch Grass Overcome

Mr. Stark seeded his pasture mixture following a Sudan crop in February, 1957. The paddock had been badly eroded after some 11 years of cultivation.

Cropping had never been a success on the sandy soil type which was originally timbered with narrow-leaf ironbark.

Soil erosion and vigorous couch grass invasion became real problems that have since vanished under the influence of the established sown pastures.

In his pasture management programme, Mr. Stark finds that at times the pasture growth outstrips his stock requirements. In such cases, he generally lets the grass seed down and then mows the area, leaving the topped grass as a soil mulch that shades and protects the soil and plant roots. This makes the pasture much more receptive to rains that normally do more harm than good.

Mr. Stark has found that correct establishment methods are important; that it pays to always use good quality seed. He prepares a suitable seed-bed; preferably fallowed. Summer plantings are the most reliable. The follow-on season in relation to rainfall is most important in establishment. A "key" point with sown pasture establishment—particularly summer species—is to have patience and not be too quick to plough-out.

If you are in doubt about grass establishment increase your lucerne rate to 2 lb. to the acre in case the season gives a slow green panic establishment. If the germination value of green panic is 40 per cent., 2 lb. of grass seed to the acre is usually adequate. Though green panic has been known to emerge from a 3 in. sowing depth, 1 in. is usually the happy medium. The sandy loams, loams and clay loams are the most suitable soil types.

Green panic and most other seeds may also be sown in May or June, more to establish the lucerne and so allow the dormant green panic to come away later in the following warm season.

Current Feeding Values

(As at 4th May, 1961)

Compiled by the Division of Animal Industry, Department of Agriculture and Stock.

Feedstuff	Average F.U./ 100 lb.	Average D.P./ 100 lb.	Average Wholesale Price (Brisbane)	Cost/lb./ F.U.	Cost/lb./ D.P.	Remarks
Starchy Concentrates—						
Sorghum	80	9	£28 per long ton	3·75	..	
Sorghum Meal	80	9	£26 per short ton	3·90	..	
Maize	80	8	£31 10s. long ton	4·22	..	
Maize Meal	80	8	£30 per short ton	4·50	..	
Wheat	75	11	15s. 6d. per bushel	4·11	..	Excluding cost bags
Wheat Meal	75	11	£30 per short ton	4·80	..	
Barley	75	9	12s. 6d. per bushel	4·70	..	
Barley Meal	75	9	£25 10s. short ton	3·80	..	
Oats	60	8	10s. 6d. per bushel	5·23	..	
Crushed Oats	60	8	11s. per bushel	5·48	..	
Pollard	65	11	£21 5s. short ton	3·93	..	Short supply
Bran	55	12	£21 5s. short ton	4·63	..	
Molasses	50	..	£5 5s. per 44 gallon drum	4·09	..	Excluding cost drum
Protein Concentrates—						
Blood Meal	60	70	£50 per long ton	..	7·85	Q.M.I.B.
Livermeal	75	50–60	£64 per long ton	..	10·56	Q.M.I.B.
Meat Meal	80	50	£55 per long ton	..	11·77	Q.M.I.B.
Peanut Meal	80	35–40	Not available	..	..	
Meat and Bone Meal	70	45	£50 per long ton	..	11·90	Borthwicks
Cottonseed Meal	65	25–35	Not available	..	..	
Skim Milk Powder	80	20–30	£95 per long ton	..	53·6–35·7	Strong demand
Butter Milk Powder	80	25–30	£90 per long ton	..	42·90–35·7	
Linseed Meal	70	25–30	£38 per short ton	..	18·24–15·20	
Coconut Meal	70	15	£37 per short ton (ex. wharf)	..	29·60	
Roughages—						
Lucerne Hay and Chaff	35	12	L/Hay £20–£22 long ton L/Chaff £30–£32 long ton	6·12–6·73 9·18–9·79	17·9–19·6 26·8–28·58	
Oaten Hay	30	3	..	..	..	
Wheaten Hay	30	4	..	..	..	
Oaten Chaff	30	3	£29 per long ton	10·35	..	
Wheaten Chaff	30	3	£29 per long ton	10·35	..	
Grassy Hay	20	3	£12–£15 long ton	6·43–8·0	..	
Mineral Supplements—	*Lime* (CaO)%	P_2O_5%				
Ground Calcium Carbonate	50	..	£9 11s. 6d. long ton	..	..	
Bone Flour	30	25	£36 per short ton	..	..	Q.M.I.B.
Superphosphate (Supernatant Fluid)	20	20	£12 6s. per long ton	..	..	
Rock Phosphate	44	36	17s. 6d. per 80 lb. bag	..	..	" Christmasphos "

Plate 1: **Horowitz Safflower is a Useful Non-Spiny Variety Which Has Performed Well Both under Trial and in Commercial Production.**

Safflower Row Spacing And Seeding Rate

By P. J. C. BRAUNS, Assistant Experimentalist.

Trials to ascertain the most suitable row spacing for safflower under Central Queensland conditions were carried out during five consecutive seasons, 1955–1959, at the Regional Experiment Station, Biloela. During the winters of 1958 and 1959 different rates of seeding were included.

Results indicate that yields of ½ to ¾ ton per acre of safflower can be obtained by employing 14-in. row spacing and planting at a rate of 27 lb. per acre. The 21-in. row spacing planted at the rate of 18 lb. per acre and 14-in. row spacing planted at 14 lb. per acre gave satisfactory yields in two seasons.

Stored Water Important

Soil at the Biloela Regional Experiment Station is a free-working clay loam that is fairly typical of the Callide Valley alluvial plain. The annual rainfall averages 28 in., but 70 per cent. of this total falls during the 6 months from October to March. It is therefore apparent that safflower, which is a winter-planted crop, must rely to a great extent on stored sub-soil moisture for its water supply. The trials were therefore conducted to find out what plant population used the available moisture and nutrient supplies most efficiently.

The safflower variety used was Horowitz—a non-spiny type (see Plate I).

Planting was carried out with a cultivator-drill ("combine") whenever sufficient planting rain was obtained in the May to July period. To avoid the risk of frost damage at flowering, planting was not attempted before early May. Safflower has a longer growing period than wheat, and a crop planted in early May will not flower at Biloela before the end of September. By this time the frost risk is slight.

Generally the 7-in. spacing produced the smallest plants. Flowering occurred earlier in these spacings—116 days after planting. The wider-spaced plots flowered 9 days later.

All treatments reached maturity at approximately the same time each year.

Row Spacings Employed

In 1955, only 7-in. and 28-in. row spacings were compared. In 1956 and 1957, 7-, 14- and 28-in. row spacings were compared. However, as the result of poor yields obtained from the 28-in. row spacing treatment, this was replaced in 1958 and 1959 by the 21-in. treatment.

The 28-in. spacing was the only treatment that was given any inter-row cultivation, and only one working was necessary each season.

Yields

Yields obtained from the various spacings are set out in Table I. It will be noticed that both the 7-in. and 28-in. spacing performed poorly throughout.

TABLE 1

EFFECT OF ROW SPACING ON YIELD

Row Spacing	Yields of Safflower (lb. per acre)		
	Yield for 1955 season	Average Yield for 1956 and 1957 seasons	Average Yield for 1958 and 1959 seasons
7-in.	777	921	1,078
14-in.	..	1,040	1,249
21-in.	..	..	1,363
28-in.	652	975	..
Averages	715	979	1,230

Note.—Bushel weight for safflower is 45 lb.

These are comparable, as the data for 1958 and 1959 seasons represent the yields when using the same header settings as in the earlier years.

Planting Rates Employed

During the 1955 to 1957 seasons only one seed setting was used. This setting planted seed in 7-in. drills at 55 lb. per acre. By shutting off appropriate drills, planting rates of 27 and 14 lb. per acre were obtained for 14- and 28-in. row spacings.

Two settings were used in the 1958 and 1959 seasons. These allowed plantings to be made at the rates shown in Table 2. Average yields for the 1958 and 1959 seasons are given.

TABLE 2

EFFECT OF PLANTING RATE ON YIELDS (1958 and 1959)

Treatment	Average Yield of Safflower (lb. per acre)
7″ at 55 lb./acre	1,090
7″ at 29 lb./acre	1,085
14″ at 27 lb./acre	1,249
14″ at 14 lb./acre	1,219
21″ at 18 lb./acre	1,363
21″ at 10 lb./acre	1,051
Average	1,176

Although 2 years of trials do not constitute a firm basis for recommendation, those obtained indicate that several treatments might be used to obtain good yields of safflower. These are 14-in. row spacings at from 14 to 27 lb. per acre and 21-in. row spacing at about 18 lb. per acre.

Safflower is an easy crop to grow and handle. In some seasons under good growing conditions, yields of seed in excess of 1 ton per acre have been obtained, although half a ton per acre can be expected in most seasons. The ruling price for safflower is not high but the average return on a ½ ton crop would be similar to the return from a 30 bus. crop of wheat.

* * *

Assistance In Income Tax Problems

The annual goodwill visits to Queensland country centres by experienced income tax assessors are arranged to provide country people with a free advice service similar to that available to Brisbane residents. The tours are especially timed to coincide with the preparation of returns so that taxpayers can have the benefit of on-the-spot advice on the many problems that arise.

This year's tours commence on Monday, July 3, and will be of 3 weeks' duration during which 67 country towns will be visited. Dates and times of the visits will be publicised extensively through press and radio. The visiting officers will be only too pleased to give assistance and advice on any problems which taxpayers may have.

—Deputy Commissioner of Taxation.

Irrigated Pasture Provides Basis For Farm Success

By R. T. WESTON, Senior Dairy Adviser.

Twenty-five acres of irrigated pasture maintains a high level of herd production for Kenilworth district farmer, Mr. A. J. Pearson.

"Seasonal conditions can be very variable, particularly in the spring," says Mr. Pearson, "and what's the use of establishing good pasture if you can't get green feed when it's most needed." The production of Mr. Pearson's herd has always been above the average for the district, but like most farmers he found that the milk yield of his cows dropped during prolonged dry periods. The reason, of course, was that there was insufficient green feed available to balance the dry roughage which was usually in plentiful supply.

It was the drought of 1957-58 which made Mr. Pearson realise that an irrigation plant on his 152-acre farm would soon pay for itself by helping to keep production at a fairly constant level throughout difficult periods.

As the result of Mr. Pearson's decision his herd averaged 207 lb. of butterfat per cow during the drought years. Compare this figure with the Kenilworth Herd Recording Group average of 153 lb. for the same period, and the real value of an assured feed supply is apparent.

Apart from the drought year of 1957-58, this 70-cow herd has produced an average of 502 gal. of milk containing 274 lb. of butterfat per head, during the last 3 years. This was 82 lb. of butterfat better than the district average for the same period.

It is perhaps in the recently completed 1959-60 recording year that this farm has achieved its greatest success. Mr. Pearson had the satisfaction of seeing his 65-cow herd reach third highest place in average cow-production for those owners milking 51 to 100 cows. His herd averaged 294 lb. of butterfat in a lactation of 291 days (almost 10 months) in contrast with an average yield of 199 lb. in a lactation of 262 days for the herd recording group of which he is a member.

Plate 1

Mr. Pearson's Son Examines the Results of a Sound Pasture Improvement Programme on their Mary River Farm.

Mr. Pearson's pasture programme started in 1955 when he planted 5 acres of rye grass and red clover, as an experiment. At the same time he planted a further 5 acres with lucerne. These plantings received a severe setback in 1956 when the Mary River was in high flood.

The results, however, were sufficiently encouraging and Mr. Pearson carried on with further plantings the following year. The initial areas were later renovated and oversown with Ladino clover.

An interesting rotation is being followed. Mr. Pearson says, "I expect the pasture to last about 5 or 6 years before it goes back to paspalum. I'll then plant maize and follow that the next year with oats and clover."

Pasture Management

Mr. Pearson is a great believer in good pasture management. All the paddocks are subdivided into 2-acre blocks with semi-permanent electric fences. "I graze my cows on the irrigated pasture for half an hour night and morning," he says. "They are then turned out into adjoining paddocks to top off on the natural paspalum sward. Apart from plenty of water, I've proved that the secret of maintaining good clover growth lies in not grazing it below 4 in. from the ground."

The spray irrigation system used draws its water from the Mary River. Each pasture strip is watered about every 14 days. Using a 3-in. centrifugal pump, it takes Mr. Pearson about 3 hours to apply 2 in. of water to an acre. The cost of watering an acre of pasture is about 12s.

Although the river flats on his farm are fairly fertile when compared with the surrounding hilly country, Mr. Pearson finds that regular top-dressing is necessary to maintain good growth. "My usual practice," he says, "is to apply a nitrogenous fertilizer such as sulphate of ammonia or urea at planting time, and then two bags of superphosphate per acre each autumn. This helps to boost pasture growth in the winter."

As might be expected there are times when Mr. Pearson has more pasture available than can be handled conveniently by the herd. He keeps surplus growth down by regular mowing, and, with the help of his neighbour's baler, made over 2,000 bales of hay last season. This is stored in a shed.

"As Much Feed As Possible"

There is no doubt in Mr. Pearson's mind that his continued high production is due mainly to good feeding. "All my farm operations are planned to provide as much feed as possible," he said, "and I don't rely on pasture alone during the winter and other lean periods. I plant up to 20 acres of maize each year, and this provides a carbohydrate-rich supplement to balance the pasture which has a high protein content."

Plate 2

Worthy members of a High-Producing Herd.

Mr. Pearson puts the whole cob through a hammermill and feeds the supplement at a lat rate of 4–5 lb. per cow per day.

With all this feed available is it any wonder that the average lactation period of the herd during the last 4 years is 292 days, or approximately 10 months?

While feed has obviously played an important part in Mr. Pearson's success, his herd management has not been neglected. He calves the majority of his cows in the months of July, August, and September, and takes advantage of the normal vigorous pasture growth during the summer. "This is a big factor in keeping the cows milking for 10 months," he says.

Herd recording has played an important part n raising herd production to its present level. Production records are used as a guide to culling, and any cow which cannot consistently produce over 200 lb. of butter fat per year is eliminated from the herd. Under Mr. Pearson's system of management each cow is certainly given ample opportunity to give of her best. If she fails to measure up, there is no point in keeping her in the herd.

Plate 3

This Two Million Gallon Dam Provides Good Stock Watering Facilities and Aids in a Successful Hygiene Programme in the Milking Shed.

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Brucellosis-Tested Swine Herds (As at 1st June, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Baker, R. L., "Baroma", Glenapp, via Rathdowney
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warree", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewood
Mack, A. J., "Culzeen", Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn," M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzeen", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., "Topcamp", via Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton," M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Need For A Reversible Disc Plough

By J. ROSSER, Soil Conservationist.

A good reversible disc plough might well have a place in those agricultural districts where the plough is the basic cultivating implement. This applies particularly to the South Burnett and Atherton areas where much of the land is undulating, and large areas have been contour-banked to control soil erosion.

Consider what a reversible plough will do hat other ploughs will not do:

Reverses Soil Drift

Plough a contour-banked paddock with a eversible plough and every furrow slice can be urned uphill. This reverses the downslope movement of soil that occurs with other farming operations. That is advantage number one.

Leaves Ground Uniform

Advantage number two is that finish-out furrows can be placed just where you want them. The gound between contour banks can be left elatively uniform.

The ideal arrangement is to plough the land between two contour banks, leaving only one finish-out furrow which is located in the channel of the lower contour bank. You can't do it with the ordinary plough that throws only one way. Try it and see. No matter how you vary the ploughing there is always an extra unwanted finish-out furrow somewhere between he banks.

With a reversible plough you can start on the back of the top bank and, by reversing the discs at the end of each run, work your way down to the channel of the lower bank. Every furrow lice is turned uphill. The ground is left uniform.

Reduces Cost of Maintaining Contour Banks

A few runs throwing onto the face of the lower bank completes the operation. A finish-out furrow is thus left in the channel. This ensures a higher bank and a deeper channel with resultant increased water-carrying capacity.

That is advantage number three. With no extra effort or time the contour bank size has been maintained and improved. Annual ploughing with the reversible plough could eliminate ordinary bank maintenance costs.

Downslope Soil Movement

Why is it necessary to arrest downslope soil movement? Contour banks are valuable aids in preventing soil erosion but we know that on their own they are not the complete answer to soil erosion. Until such time as cultivation methods and balanced land use practices provide stability there will still be downslope movement of soil between the banks. This is erosion; less spectacular than gullies, but still erosion. Under existing conditions the soil on the upper part of each contour interval will gradually become shallower. Its capacity to grow crops will be reduced.

The soil moves down with the wash that occurs between contour banks. This is small compared with the wash that occurred before we contoured. But the movement is still downslope.

It is also moved down with every farming operation. The conventional one-way plough throws downhill half of the time, uphill half of the time. But it throws more downhill with each run than it throws uphill.

The chisel plough doesn't throw either way. But the soil moves a bit downslope as the plough passes through. Watch it on the contour banks. Why do they just seem to melt away when worked with chisels? Because the soil moves downslope off each side of the bank, leaving it a bit smaller every time it is worked.

The same downslope movement occurs when you harrow, when you cultivate. Always the soil moves down. There is nothing in our present methods to move it back. A reversible disc plough would fill this need.

Maintaining Contour Banks

Maintenance of contour banks can cost money. With present equipment this cost can be avoided to some extent. For example where a chisel plough is used for the main ploughing, the contour banks can be left and ploughed with a disc plough. Or where a disc plough is used, it is possible to make one finish-out furrow in the channel of the contour bank with another higher up between the two banks. Both these methods are recommended for general usage. But they have disadvantages.

Even where the inter-bank space is chisel ploughed and the banks are ploughed up with a disc plough, some special grading-out of the channel may be needed every few years. And not every farmer finds the chisel plough alone sufficient to produce a satisfactory tilth or to adequately control weeds. Many farmers favour one ploughing followed by working with the chisel plough.

When the whole area is ploughed with the ordinary disc plough the problem of the unwanted finish-out furrow arises. Ploughing can never be reversed completely so that the finish-out furrow made one year can't be filled in the next. The best that can be done is to leave the finish-out at a different place. Over the years a general weakening of the crop will appear in the finish-out area about half way between banks.

This trouble would be avoided with a reversible disc plough, and special maintenance grading would also be a thing of the past.

◆◆◆◆◆

Seen any Flying Foxes Lately? The University of Queensland is looking for help from farmers and graziers in solving problems associated with the wanderings of flying foxes.

It was once believed that one kind of flying fox (the little red fox or honey fox) moved at random in large numbers over north and central Australia, and that other kinds of flying foxes made annual migrations, southwards in summer just before the young were born, and northwards in the winter. Observations made during field trips have shown that the movements during winter of at least two kinds of flying fox do not conform with these beliefs.

Writing on the subject, Dr. M. C. Bleakly and Mr. J. Nelson, of the Zoology Department, say: "Whilst we think it likely that earlier data has been incorrectly interpreted and do not believe that a change has occurred in the migratory behaviour of flying foxes, it must be recognised that any change of habit in such a large population of potential pests could be of economic importance. We must therefore attempt to establish more accurately the patterns of flying fox movements.

"Although we are interested in the complete biology of flying foxes, we are at present especially concerned with such questions as:

"(1) What kinds of flying foxes have been seen in your area?

"(2) Approximately how many flying foxes were in the camp? Thousands, hundreds, tens or less?

"(3) When was the camp occupied? And was it occupied at the same time every year?

"(4) Where are the camps that have been occupied in the last few years? Are there any camps that have been occupied in the past, but not in recent years? In what type of country are these camps found?

"(5) When large numbers of flying foxes leave the area, do a small number remain in the camp for a few weeks until the main mass return in the following year, or not at all?

"We would be grateful for the return of any information, even such negative information as 'no flying foxes have ever been seen in this area'."

When writing, address your letter to Mr. J. Nelson, Zoology Department, University of Queensland, St Lucia, Brisbane.

n Economic Approach To Stocking Rate

K. F. HOWARD, formerly Senior Adviser in Cattle Husbandry

Three aspects of stocking rates are discussed, namely "safe" stocking, agistment, and full ocking plus hand feeding when necessary. The examples and costs are drawn from the Miles strict and are applicable to conditions in 1958.

seasonal rainfall pattern produces seasonal der production with surpluses and deficiencies earing in a more or less regular cycle. These ural features pose problems for producers who at maximum net return per unit area, which he goal of the efficient producer. Net returns resent the difference between gross returns and ts. Gross returns can be improved by increas- production per unit area—providing the rease in production is not offset by the sacri- of such factors as quality of product nor ural assets such as soil fertility.

mprovement in production per unit area on eef property can be achieved (*a*) by improve- it in the rate of gain of animals, (*b*) increasing number of animals per unit area or (*c*) a com- ation of (*a*) and (*b*).

'or the purpose of this article it is assumed t the potential weight gaining ability of animals not affected so that the critical question is hat is the most economical stocking rate?"

ic Improvements

There are some basic property improvements which almost everyone will agree. These com- se the treatment of non-commercial timber, the vision of watering facilities and fencing for ck and pasture control. In suitable areas, provement of the natural pasture by replace- nt with more productive grasses and the pro- ion of a winter grazing crop are fairly well ablished practices. Some degree of these provements is assumed in the discussion which lows.

General Considerations

The prudent and experienced cattleman recognises that the normal dry season extends into drought fairly frequently. In fact, failure to recognise this may well lead to disaster. Three main methods are used to counter dry times and droughts. First is the so-called "safe stocking"; second, reliance on agistment during drought, and third, some form of hand-feeding. These methods are discussed in turn.

Safe Stocking

Safe stocking implies that the rate of stocking is kept at a level which ensures that there is a surplus of feed in the paddocks. This reserve is designed to supply feed in a drought. Obviously, if such a method is successful, then a property is under-stocked in all but drought or near-drought conditions. If the method is unsuccessful then drought losses are likely to occur, the extent of losses varying with the severity of the drought.

Further, there is no assurance that standing grass will be of sufficient quality to keep animals alive in a drought. Fire, also, may wipe out this type of feed unless strict precautions are taken.

A common example of safe stocking occurs when a property which could carry a cow and calf to 9 acres for the greater part of most years in fact carries only a cow and calf to 12 acres. Such a property producing weaners may have a gross income of £12 per annum for each cow and calf on the property. Taking a unit area of 900 acres, the "safe stocking" procedure allows

Plate 1

This Cypress Pine-Box open Forest Country in Taroom Area is Used for Breeding Rather than Fattening.
It is light country which responds well to spring rains. Picture taken in spring 1958.

for 75 cows and calves and a gross return of £900 compared with the heavier rate of 100 cows and calves on 900 acres to yield a gross return of £1,200. This is a gross difference of £300 a year in favour of full stocking.

Agistment

Agistment is relied upon to a big extent. At the rate of 2s. a week per adult beast, good agistment grazing is cheap. Costs of transport of stock to the agisted area must also be added.

The main difficulties involved in this method are the finding of sufficient country, suitably fenced, that will provide satisfactory feed throughout the drought. Such properties with adequate water and fences are difficult to find during a drought.

Because of continuing improvements on properties and increased stocking rates, suitable agistment is likely to become progressively more scarce.

Mustering on agistment properties after a drought frequently reveals short numbers. Such losses lead to additional mustering expenses or the writing off of the missing cattle.

Agistment has advantages from the point view of saving capital expenditure but it is uncertain method. It is scarcest when ma needed.

Full Stocking with Hand Feeding

We return now to the example given un safe stocking. There it was stated that full sto ing allowed one cow and calf to 9 acres compa with one cow and calf to 12 acres under s stocking methods. On a 900-acre unit the ference in gross returns was £300 annually.

It is recognised that some form of supp mentary fodder must be available if the stock rate of one cow and calf to 9 acres is to be ma tained. This fodder could take several for according to which were best suited to the p ticular conditions. For the purpose of mak comparisons we shall assume that the form fodder chosen is sorghum silage made on property.

A safe fodder reserve is considered to be the rate of one ton of silage per cow a year. T means 400 tons for 100 breeders every 4 yea This quantity does not allow for regular feed each year but only in exceptionally dry unfavourable years.

The cost of silage in the pit in this district is
sumed to be 33s. 6d. a ton, made up as follows:
ıe crop yield of sweet sorghum is taken as
uivalent to 7 tons of silage per acre. Crop
oduction costs £3 10s. an acre or 10s. a ton.
ntract forage harvesting costs 22s. 6d. a ton,
trench costs 1s. a ton, so the total cost on
s basis is 33s. 6d. a ton. In many cases the
op can be grown for less than £3 10s. a ton
d the cash cost could be lower if a grazier had
own silage-making equipment.

On a basis of 33s. 6d. a ton, the 4-year reserve
400 tons for 100 cows and calves would cost
70, or £168 a year. This is a cost against the
00 additional gross return obtained by full
cking. The margin in favour of full stocking
n a unit of 900 acres) is thus £132. From
s have to be taken the costs of feeding out the
age, which will vary according to equipment
d labour already available on the property. It
ould also be recognised that considerable varia-
n in the quality of sorghum silage is common
d that a poor quality product may require the
dition of a small quantity of protein supple-
nt, which would add to the cost.

In the Miles district fodder conservation and feeding back of fodder is in its infancy. Feeding out should be recognised as something of a problem. The bulky summer crops permit silage to be stored in a cheap and more or less permanent form. Besides silage, the main sources of fodder are grain and lucerne hay. Both of these would be stored when prices are below average. There are storage difficulties and costs associated with all three fodders, with silage being the cheapest.

Drought-feeding work by the Department of Agriculture and Stock as well as district experience indicate that cattle will exist for months on sub-maintenance rations. Up to the present the use of conserved fodder has been confined to the prevention of deaths. For this reason it has been mainly fed to young and aged breeders that are heavy in calf.

The amount of conserved fodder which should be fed is not easy to determine because the value and quantity of existing grass vary considerably. Figures are given for comparison.

Plate 2

Drought. Breeding properties are generally least equipped for a drought but are most vulnerable to its attack.

The amounts stated provide less than maintenance but should keep breeders alive if some dry grass is eaten. Quantities may require adjustment depending on the response of the animals.

Prices per ton for grain and silage allow for growing, harvesting and storing. £16 per ton is allowed for buying lucerne when it is cheapest, plus freight and storage.

The following are possible alternative daily rations for a cow:

—	Quantity	T.D.N. (energy)	Dig. Protein	Price	Price/ Cow Daily
	Lb.			Ton	*d.*
Sorghum . .	5	4·00	0·4	£10	5·4
Lucerne Hay . .	8	4·00	0·8	£16	13·7
Sorghum Silage	35	4·90	0·42	33s. 6d.	6·3

All feeding out costs including the cost of crushing the grain sorghum would be additional.

When sorghum is bringing a good price, it might be sound economic practice to sell the grain and buy lucerne hay.

Grain and silage should be fed out in troug while hay is best fed in racks fitted with trough beneath to catch the leaves, which the most valuable part. One man should able to feed 200 cows a day on silage, wh labour requirements for feeding out hay and grain are less.

Feeding of silage at the rate of 35 lb. a would mean that 3 tons would feed a bree for six months for £5 0s. 6d. plus the cost feeding out. This is sound insurance. Ev when fairly heavily stocked, it is unlikely t feeding would have to be carried out any long than 6 months. The alternative to feeding generally to sell the breeders at about £10 bel their normal value.

Some cattle will not eat silage or grain wh it is first offered to them and some extra att tion may be needed for a few days. In the ca of heifers which are destined to become breed some yard-feeding for a few days at weani time could prove well worthwhile. Once st have been educated to eat they seldom requ further encouragement in later life.

Plate 3

This Bull was no Trouble to Feed on Silage during the 1957 Drought.

eef Cattle Measurements nd Show Ring Performance

G. I. ALEXANDER, Senior Cattle Husbandry Officer.

At the Brisbane Exhibition the Department Agriculture and Stock co-operated with the yal National Association in the weighing of stud beef cattle. The animals were also asured in an effort to correlate linear measurents with liveweight and to describe the cattle re accurately. As in past years the co-operan of the exhibitors showed they were very n to participate in this programme.

While the breeding of high quality stud beef tle is a very complex art, there are many entific aids which can be used with success make selections easier and more efficient. e correct feeding of stud beef bulls has been reduced down to scientific formulae as far as we are able when dealing with nature. Just as the stud breeder keeps a careful check on the theoretically calculated feed ration when feeding his bulls, so he can resort to objective standards when considering the worth of his bull. These standards, such as linear body measurements, weight-for-age, efficiency of use of fodder, which can all be incorporated in the term "performance testing" must play an increasing role in the evaluation of beef cattle.

These annual measurements at the Brisbane Exhibition have been taken with the object of assisting beef stud men to keep an unbiassed record of the merit of the stock at the various

Plate 1

Russley Jacobite"—Grand and Junior Champion horthorn Bull. Girth, 71; Length, 53; Round, 40; Weight, 850 lb.

Plate 2

"Lee Masterpiece"—Junior Champion Poll Shorthorn Bull. Girth, 78; Length, 60; Round, 45; Weight, 1,232 lb.

Brisbane Exhibitions and so measure the progress in cattle breeding and feeding.

The following measurements were taken of cattle: live weight, heart girth, body length and round measurement. From the body weight (corrected for birth weight by substracting a standard 70 lb. from each weight) and the age at the commencement of the Exhibition, the weight-for-age of each animal was calculated.

TABLE 1

Breed Numbers Weighed and Measured—Brisbane Show 1960

Breed	Cattle Weighed and Measured		
	Males	Females	Total
Shorthorn	37	14	51
Poll Shorthorn	90	21	111
Hereford	121	16	137
Poll Hereford	128	38	166
Devon	22	7	29
Poll Devon	2	4	6
Angus	41	18	59
Brahman	4	3	7
Santa Gertrudis	7	1	8
Droughtmaster	9	6	15
Red Poll	4	5	9
Total	465	133	598

All the exhibited breeds of beef cattle w considered and in all, 598 head were weig and measured (Table 1). These animals w representative of every age class judged at Show. The class averages are shown in Tabl and breed averages in Tables 4 and 5. For e of comparison, all measurements are recor in inches.

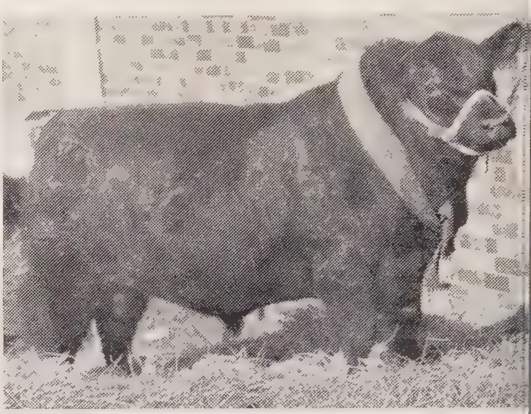

Plate 3

"Sarum Graft"—Junior Champion Angus Bu Girth, 83; Length, 66; Round, 51; Weight, 1,530

TABLE 2

Average Weights and Measurements of Bulls and Heifers in Age Groups

Age Groups (all breeds)	Weight (lb.)	Weight-For-Age (lb./day)	Girth (in.)	Length (in.)	Round (in.
Bulls—					
3 years and over	1,794	1·41	92	72	55
2 years and over	1,673	1·72	86	70	50
2 years–3 years	1,780	1·92	91	70	51
21 months–2 years	1,546	2·04	85	67	49
18 months–21 months	1,389	2·07	82	65	48
15 months–18 months	1,279	2·19	80	63	47
12 months–15 months	1,118	2·28	75	60	45
10 months–12 months	1,072	2·57	74	60	45
6 months–10 months	917	2·71	70	57	43
6 months–12 months	864	2·25	68	56	41
18 months–2 years	1,334	1·93	81	65	49
Over 18 months	1,573	1·98	82	67	50
12 months–18 months	1,064	2·06	74	62	44
Under 18 months	1,093	2·36	72	59	45
Heifers—					
2 years and over	1,255	..	81	63	44
18 months–2 years	1,078	1·45	76	59	44
Over 18 months	1,195	..	78	64	46
Under 18 months	779	1·94	67	56	40
Under 12 months	932	1·67	72	57	42
6 months–12 months	746	1·91	67	54	40

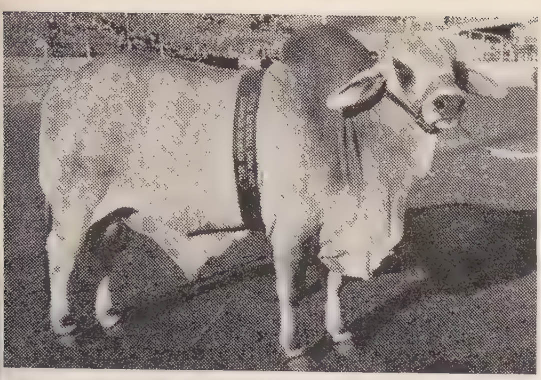

Plate 4

“Cherokee La Valentine Manso”—Champion Brahman Bull. Girth, 86; Length, 67; Round, 55; Weight, 1,795 lb.

easurements

Heart Girth.—This is the measurement of the ircumference of the chest and is taken in the egion over the fifth and sixth thoracic vertebrae. his corresponds with that part of the animal irectly behind the shoulder blades. When taking his measurement, the smallest circumference of he chest should be sought, and the tape should e pulled firmly but not tightly about the beast. rovided the correct technique is used, heart irth is one of the easiest and most valuable easurements to take. It is subject to less error n the field than most other linear measurements nd is very closely related to weight.

Round Measurement.—This measurement aken around the buttocks with the front of the ifle on each side being taken as the fixed points.

Weight.—Weight alone is a very useful measure hen the stock are of comparable ages. However, when there is some range in the ages of he animals, weight alone loses a lot of its ccuracy. For this reason rate of gain has come o be used. This is actually the weight of the nimal corrected for its age. Rate of gain is robably the most valuable characteristic of a eef animal. Rate of gain as it is used in this aper is actually weight-for-age. Weight-for-age an be broken down into three component parts, irth weight, suckling gain and post-weaning ain. Since the birth weights of the stock are nknown, a standard birth weight of 70 lb. has een used. It is not possible to separate the suckling gain from the post-weaning gain. Of the two, the latter is more strongly heritable and is the one which can be most influenced by selection, especially in stall-fed stud cattle.

Since the growth rate of cattle slows down as the animals reach sexual maturity, weight-for-age is most useful in the younger stock.

TABLE 3

ESTIMATION OF WEIGHT FROM HEART GIRTH

Breed	1960		1954–60	
	No.	Formula	No.	Formula
Shorthorn . .	34	W = 36 (G–46)	186	W = 38 (G–46)
Poll Shorthorn	90	W = 40 (G–47)	272	W = 39 (G–47)
Hereford . .	121	W = 41 (G–48)	656	W = 40 (G–47)
Poll Hereford	128	W = 39 (G–47)	530	W = 40 (G–48)
Angus . .	41	W = 38 (G–46)	182	W = 39 (G–46)
All Breeds . .	465	W = 40 (G–47)	1874	W = 40 (G–48)

Calculating Weight from Girth.—The relationship between heart girth and weight was again investigated to see if further modification would be necessary to the formulae derived over the past 4 years. Table 3 lists the formulae for the various breeds for 1960 and for all years including the 1960 measurements. An examination of the formulae for the aggregate indicates that only slight changes have occurred from those developed up till the 1957 Exhibition. In the younger classes, bulls generally weigh lighter than the calculated weight while the reverse holds for bulls in the older classes.

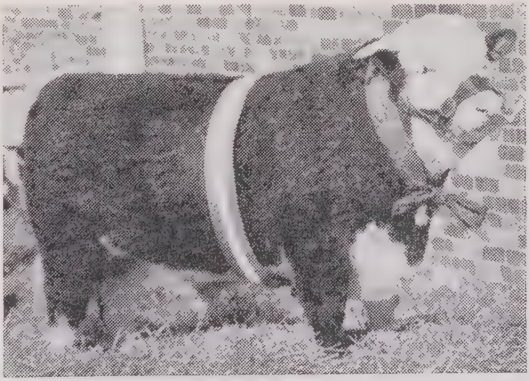

Plate 5

“Woodlands Man-O-Iron”—Grand and Junior Champion Hereford Bull. Girth, 84; Length, 67; Round, 48; Weight, 1,352 lb.

TABLE 4

Average Weights and Measurements of Bulls of Individual Breeds

Age Group and Breed	Weight (lb.)	Weight-For-Age (lb./day)	Girth (in.)	Length (in.)	Round (in.)
1. 3 years and over—					
Poll Hereford (1) . .	1,794	1·41	92	72	55
Class average (1) . .	1,794	1·41	92	72	55
2. 2 years and over—					
Shorthorn (1) . .	1,650	1·68	88	70	48
Poll Shorthorn (11)	1,746	1·72	88	75	49
Hereford (8) . .	1,797	2·00	89	69	53
Devon (3)	1,524	1·58	78	67	47
Angus (8)	1,516	1·53	84	64	49
Poll Devon (1) . .	1,740	1·30	87	69	51
Red Poll (1) . .	1,538	1·84	81	70	46
Class average (33) . .	1,673	1·72	86	70	50
3. 2 years and under 3 years—					
Poll Hereford (9) . .	1,780	1·92	91	70	51
Class average (9) . .	1,780	1·92	91	70	51
4. 21 months–2 years—					
Shorthorn (7) . .	1,421	1·87	83	66	46
Poll Shorthorn (15)	1,470	1·96	83	65	47
Hereford (25) . .	1,662	2·20	88	69	51
Poll Hereford (11) . .	1,585	2·09	86	68	50
Angus (5)	1,282	1·67	80	63	46
Class average (63) . .	1,546	2·04	85	67	49
5. 18–21 months—					
Shorthorn (8) . .	1,365	1·99	81	64	47
Poll Shorthorn (21)	1,294	1·96	80	63	45
Hereford (22) . .	1,476	2·21	84	67	50
Poll Hereford (24) . .	1,466	2·18	84	67	49
Angus (9)	1,217	1·79	77	62	45
Class average (84) . .	1,389	2·07	82	65	48
6. 18–24 months—					
Devon (10)	1,348	1·93	82	66	49
Poll Devon (1) . .	1,190	1·91	78	60	46
Class average (11) . .	1,334	1·93	81	65	49
7. Over 18 months—					
Brahman (2) . .	1,387	1·42	79	64	50
Santa Gertrudis (3)	1,713	2·13	84	66	53
Droughtmaster (4) . .	1,561	2·14	81	69	48
Class average (9) . .	1,573	1·98	82	67	50
8. 12–18 months—					
Devon (6)	1,064	2·06	74	62	44
Class average (6) . .	1,064	2·06	74	62	44
9. Under 18 months—					
Brahman (2) . .	858	2·49	68	55	43
Santa Gertrudis (4)	1,188	2·28	75	60	48
Droughtmaster (5) . .	1,111	2·37	72	60	44
Class average (11) . .	1,093	2·36	72	59	45
10. 15–18 months—					
Shorthorn (5) . .	1,164	2·03	77	60	45
Poll Shorthorn (21)	1,142	1·98	76	61	44
Hereford (26) . .	1,394	2·39	82	66	49
Poll Hereford (28) . .	1,316	2·22	81	64	48

TABLE 4—*continued*

Average Weights and Measurements of Bulls of Individual Breeds—*continued*

Age Group and Breed	Weight (lb.)	Weight-For-Age (lb./day)	Girth (in.)	Length (in.)	Ro (i
Angus (6)	1,178	1·99	77	60	
Class average (86) . .	1,279	2·19	80	63	
11. 12–15 months—					
Shorthorn (10) . .	1,007	2·05	73	57	
Poll Shorthorn (9) . .	1,016	2·13	72	59	
Hereford (14) . .	1,210	2·45	78	63	
Poll Hereford (24) . .	1,180	2·41	77	61	
Angus (7)	1,008	2·00	72	58	
Class average (64) . .	1,118	2·28	75	60	
12. 10–12 months—					
Hereford (19) . .	1,112	2·66	75	61	
Poll Hereford (14) . .	1,018	2·44	73	58	
Class average (33) . .	1,072	2·57	74	60	
13. 6–10 months—					
Hereford (7) . .	950	2·71	70	58	
Poll Hereford (17) . .	903	2·71	70	56	
Class average (24) . .	917	2·71	70	57	
14. 6–12 months—					
Shorthorn (6) . .	827	2·14	67	54	
Poll Shorthorn (15)	906	2·34	69	56	
Angus (6)	852	2·21	68	55	
Devon (3)	812	2·07	67	57	
Red Poll (2) . .	769	2·36	65	58	
Class average (32) . .	864	2·25	68	56	

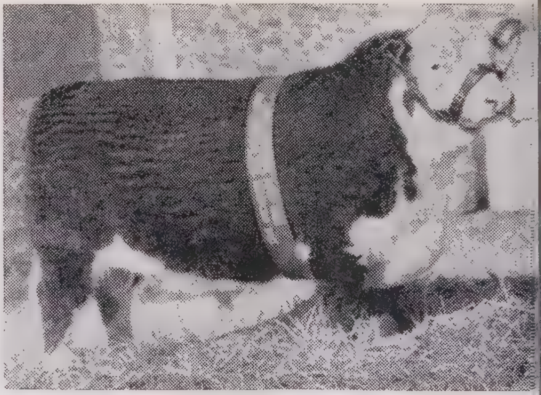

Plate 6

"Sandalwood Captain Mischief 2nd"—Junio
Champion Poll Hereford Bull. Girth, 84; length, 64
Round, 46; Weight, 1,422 lb.

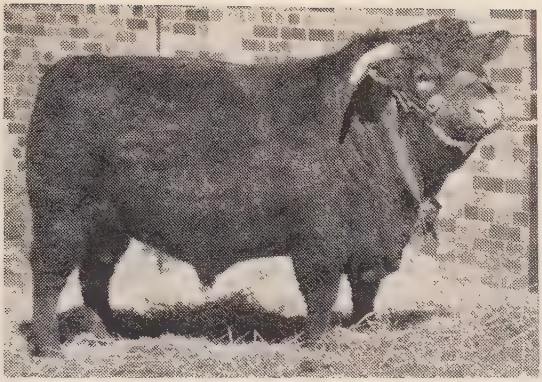

Plate 7

"Havilah Briton 20th"—Champion Devon Bull.
Girth, 85; Length, 72; Round, 50; Weight, 1,572 lb.

The calculation of these formulae is based entirely on measurements and weights taken at the Show and it is therefore specifically for use with Show bulls.

It is unfortunate that insufficient cattle of the other breeds—Devon, Brahman, Santa Gertrudis, Droughtmaster and Red Poll—are presented to allow formulae to be developed for these breeds. It is to be expected that the formulae developed for the breeds incorporating Indian types would be radically different from those for British breeds. These formulae are developed for cattle in show condition and would be of little value for fat show steers or commercial cattle.

Weight-for-Age.—The average rate of gain in pounds per day is shown for all classes of cattle in Tables 2, 4 and 5. This figure has been obtained by dividing body weight by the number of days to the commencement of the Exhibition. Before the calculation was made an allowance for weight at birth was deducted from the total weight. The birth weight was taken to be 70 lb. for this purpose. Of course, this birth weight would tend to favour some breeds and be detrimental to others but, within a breed, it reduces all animals to a common basis. Rate of gain per day is more accurate than actual weight for purposes of comparison since it eliminates differences due to variation in the dates of birth of animals within one class.

As discussed in the brochure for 1958 Exhibition, rate of gain is influenced by many factors but within each class it can be used as a very accurate index of the worth of an animal. This is especially so since rate of gain is quite highly heritable and so one can expect to make good progress in this quality by selecting bulls for high growth rate.

TABLE 5

AVERAGE WEIGHTS AND MEASUREMENTS OF HEIFERS OF INDIVIDUAL BREEDS

Age Group and Breed	Weight (lb.)	Weight-For-Age (lb./day)	Girth (in.)	Length (in.)	Round (in.)
1. 2 years and over—					
Shorthorn (4) ..	1,198	1·26	80	60	43
Poll Shorthorn (3) ..	1,330	1·00	83	62	43
Hereford (0)	..	..	..	..	..
Poll Hereford (5) ..	1,349	1·17	83	65	46
Devon (2)	1,262	..	82	64	34
			(one only measured)		
Angus (5)	1,232	1·05	81	62	46
Poll Devon (2) ..	1,267	·91	80	65	43
Red Poll (2) ..	1,058	1·05	73	65	39
Class average (23) ..	1,255	..	81	63	44
2. 18 months–2 years—					
Shorthorn (2) ..	1,087	1·42	76	58	40
Poll Shorthorn (4) ..	957	1·37	72	56	43
Hereford (5) ..	1,188	1·72	78	63	46
Poll Hereford (14) ..	1,101	1·47	77	60	45
Devon (2)	949	1·22	78	59	44
Angus (5)	1,046	1·32	76	58	42
Class average (32) ..	1,078	1·45	76	59	44
3. Over 18 months—					
Brahman (1) ..	1,404	..	80	67	47
Santa Gertrudis (1)	1,250	..	81	61	45
Droughtmaster (1) ..	930	1·40	72	..	..
Class average (3) ..	1,195	..	78	64	46
4. Under 18 months—					
Brahman (2) ..	688	1·68	70	51	39
Droughtmaster (5) ..	816	2·05	66	58	40
Class average (7) ..	779	1·94	67	56	40
5. 12–18 months—					
Shorthorn (6) ..	825	1·64	70	53	39
Poll Shorthorn (5) ..	820	1·31	68	56	38
Hereford (7) ..	1,016	1·84	74	59	45
Poll Hereford (9) ..	1,050	1·83	76	60	43
Devon (1)	922	1·48	72	59	42
Angus (3)	945	1·58	73	57	43
Poll Devon (2) ..	717	1·59	66	55	39
Red Poll (1) ..	892	1·76	68	59	38
Class average (34) ..	932	1·67	72	57	42
6. 6–12 months—					
Shorthorn (2) ..	692	1·55	64	53	37
Poll Shorthorn (9) ..	719	1·76	65	51	38
Hereford (4) ..	838	2·11	70	57	43
Poll Hereford (10) ..	784	2·16	68	54	41
Devon (2)	706	1·58	70	59	42
	(only one weighed)				
Red Poll (2) ..	582	1·63	60	53	36
Class average (29) ..	746	1·91	67	54	40

TABLE 6

Average Girths and Weights for Bulls and Heifers in Each Class in the Years 1953–1960

(*a*) Average Girths—Bulls :

Age Groups (All Breeds grouped together)	Girth (in.)						
	1953	1954	1955	1956	1957	1959	1960
1. 3 years and over	..	..	..	..	..	..	92
2. 2 years and over	88	89	87	88	89	86	86
3. 2–3 years	..	..	..	..	..	..	91
4. 21 months–2 years	84	85	83	85	85	84	85
5. 18 months–21 months	82	83	82	84	83	81	82
6. 15 months–18 months	79	80	80	81	80	80	80
7. 12 months–15 months	77	77	77	78	78	76	75
8. 10 months–12 months	74	74	72	74	75	75	74
9. 6 months–10 months	71	68	69	71	70	71	70
10. 6 months–12 months	69	67	69	70	70	69	68
11. 18 months–2 years	81	82	..	..	..	..	81
12. Over 18 months	..	..	..	..	..	..	82
13. 12 months–18 months	..	..	..	..	..	..	74
14. Under 18 months	..	..	..	..	..	..	72

(*b*) Average Weights—Bulls :

Age Groups (All Breeds grouped together)	Weight (lb.)						
	1954	1955	1956	1957	1958	1959	1960
1. 3 years and over	..	..	..	..	..	..	1,794
2. 2 years and over	1,763	1,646	1,638	1,725	1,623	1,641	1,673
3. 2 years–3 years	..	..	..	..	..	..	1,780
4. 21 months–2 years	1,540	1,456	1,525	1,516	1,455	1,513	1,546
5. 18 months–21 months	1,415	1,417	1,442	1,425	1,333	1,398	1,389
6. 15 months–18 months	1,339	1,290	1,310	1,262	1,202	1,347	1,279
7. 12 months–15 months	1,193	1,149	1,217	1,183	1,100	1,166	1,118
8. 10 months–12 months	1,084	1,005	1,053	1,071	1,002	1,092	1,072
9. 6 months–10 months	859	892	934	879	922	946	917
10. 6 months–12 months	831	907	895	892	884	892	864
11. 18 months–2 years	..	..	..	..	..	..	1,334
12. Over 18 months	..	..	..	..	..	..	1,573
13. 12 months–18 months	..	..	..	..	..	..	1,064
14. Under 18 months	..	..	..	..	..	..	1,093

(*a*) Average Girths—Heifers :

Age Groups (All Breeds grouped together)	Girth (in.)						
	1953	1954	1955	1956	1957	1959	1960
1. 2 years and over	82	79	80	84	84	82	81
2. 18 months–2 years	76	77	77	78	79	75	76
3. Over 18 months	..	..	..	..	..	78	78
4. Under 18 months	..	..	..	..	..	60	67
5. 12 months–18 months	74	73	74	75	74	72	72
6. 6 months–12 months	67	66	65	67	68	66	67

(*b*) Average Weights—Heifers :

Age Groups (All Breeds grouped together)	Weight (lb.)						
	1954	1955	1956	1957	1958	1959	1960
1. 2 years and over	1,271	1,191	1,349	1,339	1,290	1,365	1,255
2. 18 months–2 years	1,099	1,068	1,060	1,098	1,106	1,051	1,078
3. Over 18 months	..	..	..	..	..	1,243	1,195
4. Under 18 months	..	..	..	..	..	555	779
5. 12 months–18 months	910	931	960	910	923	918	932
6. 6 months–12 months	708	695	750	768	701	..	746

Uses for Weights and Measurements.—This service is providing a very useful "memory" for the stud beef breeder. One of the most difficult parts of beef cattle breeding is the necessity to compare livestock in successive years. Besides being one of the most difficult jobs of a studmaster it is one of the most important. This recording of weights and measurements at the Brisbane Exhibition serves as a permanent record of some of the more important indices of growth and conformation. Table 6 shows the average girth and weight of bulls and heifers since this service was initiated.

Besides providing this aid to the memory of the studmaster, this animal weighing and measurement assists in the preparation of stock for the Show. It establishes some measure whereby the studmaster can determine whether his stock will compare favourably with the other animals exhibited in the same class. While eye appraisal has so far been the only measure of whether cattle are "finished" or not, these measurements do provide an indication of the conformation of the cattle. Where no weighbridge is available, regular girth measurements will provide an indication of the growth rate of the animal.

Another aid which these weights provide is the calculation of weight-for-age.

Acknowledgements

Thanks are accorded to the Royal National Association for permission to carry out the weighings and measurements; the owners, stud grooms and attendants who were so co-operative; Patterson's Scale Supply and Service who provided the weighbridge; "Country Life" Newspaper for photographs; and to the various other members of the Cattle Husbandry Branch who assisted in the weighing and measuring.

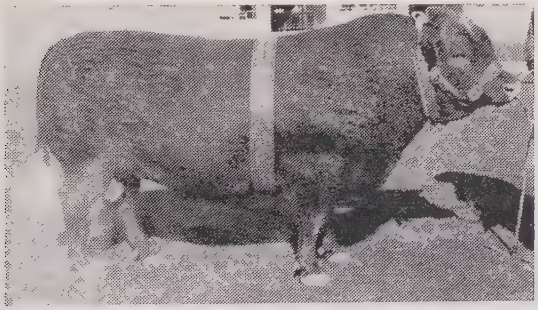

Plate 8

"Strathmore Caesar of Devonshire"—Champion Poll Devon Bull. Girth, 87; Length, 69; Round, 51; Weight, 1,740 lb.

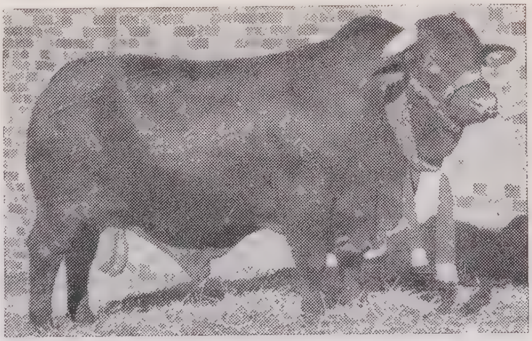

Plate 9

"Risdon Emperor"—Champion Santa Gertrudis Bull. Girth, 93; Length, 70; Round, 55; Weight, 2,206 lb.

Double Needle Vaccination For Fowl Pox

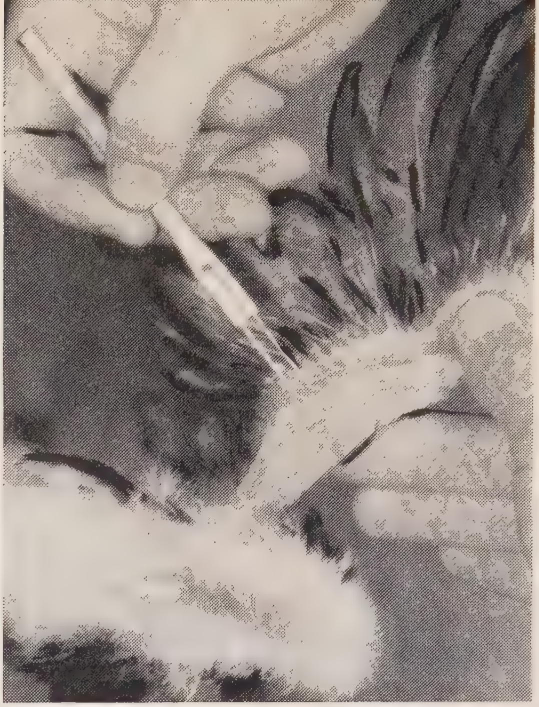

Plate 1

The Double Needle Applicator Held Ready for Stabbing Through the Wing Web of a Young Chicken. Note the wing web being stretched by the fingers to aid penetration by the needles. On account of its sharp points, the double needle applicator is especially suitable for penetrating the wing web which offers more resistance than the leg site.

By P. D. RANBY, Divisional Veterinary Officer (Poultry Disease Specialist).

A new double needle applicator for fowl pox vaccination is described which has advantages over the previous types of applicators.

Vaccinating the new season's chickens to protect them from fowl pox is common practice in Queensland. Fowl pox appears in the form of wart-like nodules on the face, comb and wattles of affected birds. The disease is spread mainly by virus-carrying mosquitoes. Although fowl pox is not a "killer", the disease causes loss of egg production in laying fowls and reduces the resistance of chickens to other diseases.

Two vaccines are available for vaccinating against fowl pox. Pigeon pox vaccine produces a temporary immunity while fowl pox vaccine produces a life-lasting immunity. Where pigeon pox vaccine is used, the dose is applied to the exposed feather follicles of the chicken's leg by means of a brush (follicle method). Where fowl pox vaccine is used, two methods of vaccination are available. One may apply the vaccine by the follicle method as used for pigeon pox, or penetrate the bird's skin with a needle type of applicator (stab method). For the details of fowl pox vaccination readers are referred to a previous article as follows: "Protect Chickens and Poults Against Fowl Pox", *Queensland Agricultural Journal,* 1959 (November).

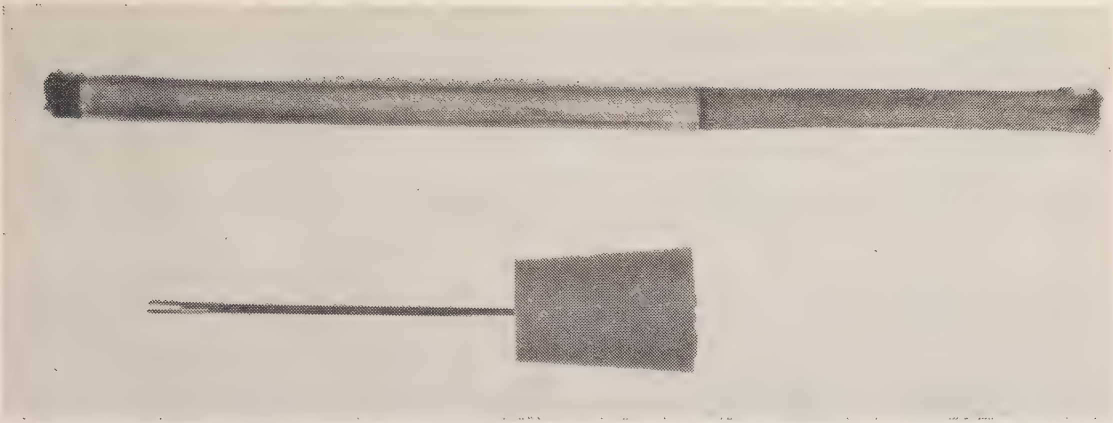

Plate 2

Standard Type Applicators Used for Fowl Pox Vaccination. Above: A "fowl pox" or "vaccinating" brush made from ox hair. Below: A single needle applicator made from a hand sewing needle. The single needle applicator is faster than the brush but is suitable only for fowl pox vaccine.

The follicle method of using fowl pox vaccine appears to have been the first used to any extent in Queensland although in the last few years a number of poultry farmers have changed to the stab method using a "needle". (In New South Wales, the stab method is the main one used).

Standard Type Applicators

The vaccinating instruments (applicators) used in the past have been the "fowl pox" or "vaccinating" brush used by the follicle method and a single needle applicator used in the stab method. Most poultry farmers have one or other of these applicators on hand.

Vaccinating Brush.—The fowl pox vaccinating brush consists of fibres of ox hair bound firmly together as a bundle by a piece of sheet metal bent in the form of a cylinder as seen in Plate 2. The brush itself is about one quarter of an inch long.

The volume of vaccine required is 10 to 12 ml. (cc) per 300 chickens. The brush is dipped into the vaccine and excess vaccine removed by wiping the brush on the neck of the bottle. Feathers are removed from an area on the outside of the leg above the hock joint, exposing the feather follicles. The dose of vaccine is applied by brushing it on to the exposed feather follicles (follicle method).

The follicle method of vaccinating is suitable for a vaccinating team of two, but where a team of three is available (as desired) the method is rather slower than the stab method.

Single Needle Applicator.—Usually referred to as a "fowl pox needle" the single needle type of applicator (see Plate 2) is made from a hand sewing needle as follows:

Cut through the eye of a sewing machine needle (the eye being near the back of the needle), leaving two prongs about one-eighth of an inch long. Bevel the edges of the prongs as shown in Plate 2. The pointed end of the needle is now pushed into a cork or rubber which acts as a handle.

The volume of vaccine required is approximately 1 ml. per 200 chickens but the strength of the vaccine is two to three times greater than that used by the follicle method.

The bird is inoculated by puncturing the skin of the bird with the prongs of the needle, the dose of vaccine being held by the prongs. The usual site of inoculation is the wing web in young chickens (4 to 6 or 7 weeks old) and a fold of skin at the back of the thigh in older chickens (over 6 or 7 weeks old). Each chicken is "stabbed" twice. This is necessary since one stab will fail to "take" in about 5 per cent. of the birds.

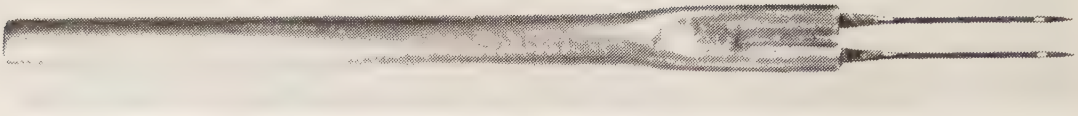

Plate 3

Front End of the Double Needle Applicator. Note the "eye" near the point of each needle. The dose of vaccine is carried from the "eye" into the bird's skin immediately after penetration.

Using the stab method with a single needle applicator, vaccinating speeds of up to 800 an hour can be achieved with a team of three (assuming that pen layout and vaccinating facilities are satisfactory). This is faster than the follicle method where speeds up to 500 per hour are usual.

Double Needle Applicator

Early in 1960 we developed a double needle applicator for fowl pox vaccination. This type of applicator is made from two sewing machine needles. The double needle applicator is used by the stab method but only one stabbing movement is required instead of two movements for a single needle applicator. The double "needle" also has other advantages.

Materials Required.—The double needle applicator is quite simple to make. The materials required are shown in Plate 4 as follows:

1. A hollow copper tube of one quarter inch external diameter and 3 to 4 in. long ("A" in Plate 4).
2. A bent piece of wire about 4 in. long of the same thickness as the back of a sewing machine needle. The wire is bent to form two prongs about one-quarter of an inch apart ("B" in Plate 4).
3. A round-head nail ("C" in Plate 4).
4. A thick U-shaped piece of wire (gauge 8), the prongs each being about 3 in. long ("D" in Plate 4).
5. Two sewing machine needles. In this type of needle, the "eye" is close to the point of the needle as shown in Plate 3. In addition, grooves run in both directions from the eye. These grooves aid the movement of vaccine from the eye after the needle punctures the bird's skin. The needles are shown fixed in position in Plate 3.
6. A hammer and a vice, as available in any carpenter's workshop.

Making the Double Needle

The different stages in the preparation of the double needle are shown in Plates 4, 5, 6 and 7.

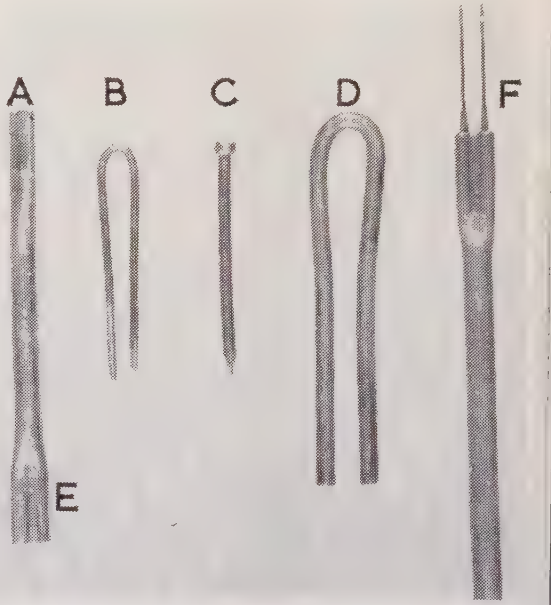

Plate 4

Materials Required for Making the Double Needle Applicator. A: A copper tube of one quarter inch external diameter. B: A wire of about the same thickness as the shank of a sewing machine needle, bent to form two prongs about one-quarter of an inch apart. C: A flat-head nail. D: A thick U-shaped piece of wire (gauge 8) with prongs about 3 in. long. E is an intermediate stage in the preparation of the applicator and F the completed instrument. Two sewing machine needles are shown fixed in position in F. Other materials required are a hammer and a vice.

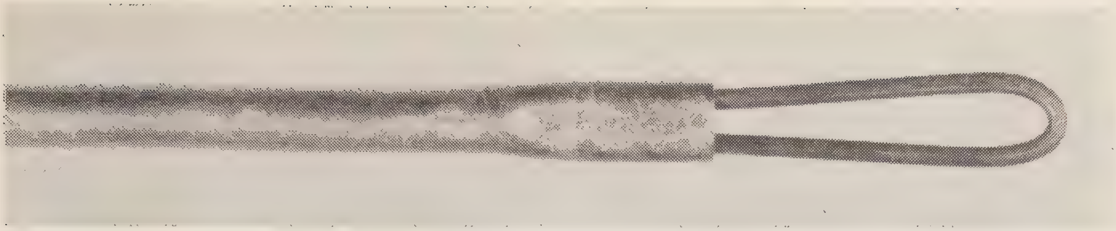

Plate 5

Prongs of Wire B Inserted into the Oval End of Copper Tube A. The wire now forms a loop outside the tube.

1. Press or tap one end of the copper tube to form an oval opening instead of a circular one ("A" in Plate 4).
2. Insert the prongs of wire "B" into the oval opening of the tube. The wire now forms a loop outside the tube as shown in Plate 5.
3. Place the nail "C" lengthwise along the copper tube "A" and wire loop "B" as shown in Plate 6. Now tap the nail with a hammer, impressing a groove into the copper tube ("E" in Plate 4). Repeat on the opposite side. The copper tube will now be pressed in between the prongs of wire "B" to form two incomplete cylindrical tubes with openings.
4. Insert the two sewing machine needles into the two incomplete openings of the copper tube. (Shanks of needles are inserted). The needles are held loosely.
5. The aim now is to press further the two grooves on the copper tube until they meet and to press the soft metal firmly around the sewing machine needles. This is done by using the U-shaped wire "D" and a vice. Slip the wire prongs of "D" lengthwise over the copper tube which is loosely holding the sewing machine needles as shown in Plate 7. The prongs will lie more or less over the grooves already made on the copper tube. The whole is held in a vice. As the vice closes, it touches and presses the two prongs of wire "D" which, in turn press into the two grooves on the copper tube. The two needles are squeezed slightly sideways during this process, but the soft copper metal is firmly pressed around them. The final product is shown in Plate 3 and as "F" in Plate 4.

The double "vaccinating needle" is shown in action in Plate 1.

Advantages

The advantages of the double needle applicator are:

1. Since only one stabbing movement is necessary instead of two as in the older type of applicator, the vaccinating time is

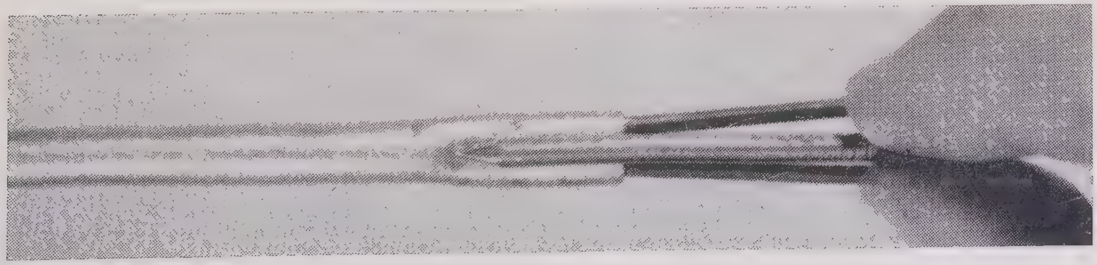

Plate 6

Nail C is Held Lengthwise along the Copper Tube A. The nail is ready to be tapped with a hammer to impress a groove into the tube. The wire is then removed and two sewing machine needles inserted.

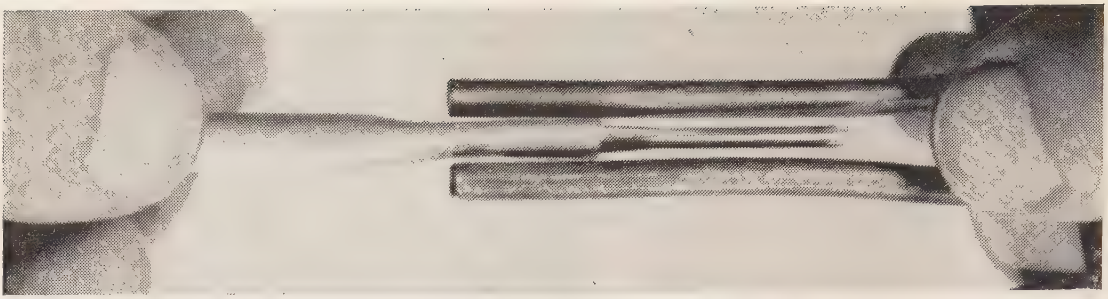

Plate 7

The Prongs of U-Shaped Wire D is Shown Held Lengthwise over the Copper Tube which is Loosely Holding the Two Sewing Machine Needles. The prongs will be over the grooves already made on the copper tube. The whole is held in a vice in the position shown. As the vice closes it presses the two prongs which, in turn, deepen the tube grooves already present and squeeze the soft copper metal sideways to fit around each needle.

reduced by 15 to 20 per cent. Vaccinating speeds up to 900 or more per hour can be reached.

2. The points of the double needle are sharper and penetrate the skin more easily. This is important where the wing web site is used, because the wing web is thicker and tougher than the fold of skin on the thigh. The prongs of the single needle applicator are not in the form of points and do not penetrate as easily. The double needle applicator is thus particularly suitable for the wing web site of inoculation, as shown in Plate 1.

3. The dose inoculated by the double needle is fairly constant since sewing machine needles vary only slightly. On the other hand the dose used by the single needle applicator varies with the size of the original hand sewing needle, the size of the eye and the length of the prongs. Using the double needle applicator (using "Singer" type needles), 3 ml. of vaccine should be sufficient for over 600 chickens.

4. The dose of vaccine in the eye of this type of needle is not likely to be wiped off by feathers when making the stab.

Australian Dairy Industry: An Economic Study

Edited by N. T. DRANE and H. R. EDWARDS

F. W. Cheshire, Melbourne, 1961. 84s.

This is a translation in book form of a report prepared by the Faculty of Economics, University of Sydney, at the request of the Australian Dairy Farmers' Federation, and presented in final form in May 1959.

The major part of the book is a comprehensive study bringing together statistics and supplementary data from a wide range of sources, with particular attention to the supply and demand for dairy products, investment and incomes of dairy farmers, and government controls. The book is fully documented, the only notable omission from the references being the recent report of the Committee of Inquiry which had not been completed when this book went to press. There are 109 statistical tables, 17 graphs and a map showing recent changes in the distribution of dairy cattle in Australia.

The authors claim that the real problem of the dairy industry has been consistently ignored by policy makers. This is the tendency to increase output whenever the price of butterfat rises sufficiently to yield a profitable margin over costs, which reaction tends to bring prices down again until the incentive to expansion is removed.

They believe that demand for dairy products will continue to grow during the next decade, but warn that the industry will be relatively depressed if its supply expands at a faster rate. In the concluding chapter, they propose a plan for raising dairy incomes by the establishment of a Regional Economic Development Service, and the adoption of a two-price system based on domestic market quotas.

Potato Growing In Queensland

Contributed By Agriculture Branch.

Potatoes are grown successfully in many districts in Queensland, mostly with the aid of irrigation. As irrigation facilities have increased in the potato growing districts there has been a pronounced expansion in the volume of production within the State. This is demonstrated by the fact that whereas the average annual production for the 3 year period ending in 1939-40 was 21,351 tons, production for the 3 year period to the end of the 1957-58 season had risen to an average of 47,842 tons. However, this is still below Queensland's between-season requirements and during the period just mentioned it was necessary to import an annual average of about 10,000 tons from southern States. The yield during that period was approximately 3·8 tons to the acre as compared with just under 2 tons in the 3 pre-war years.

The main potato growing districts are located in the south-eastern portion of the State, 85 per cent. of the 1957-58 production being in the Moreton Statistical Division. The Townsville and Cairns Divisions were responsible for 5·2 and 4·9 per cent. respectively of that year's crop.

Soil Requirements

Potatoes can be grown satisfactorily on almost any well-drained soil of reasonable fertility, but the crop thrives best on deep, fertile loamy soils containing adequate quantities of organic matter. Heavy clay soils and soils which are badly drained and liable to become waterlogged should be avoided because not only are the chances of raising a crop very limited on such soils, but tubers of good shape and quality cannot be produced on them.

Crop Rotation

If potatoes are grown continuously for a number of years care must be taken to preserve the physical condition of even the best soils by keeping up the supply of humus. High yields cannot be maintained otherwise. The soil may be kept in satisfactory condition to a large extent by crop rotation, by ploughing in bulky green manure crops and by using liberal quantities of farmyard manure where it is available. The green manure crops which should form part of a planned rotation, and preferably precede the potato crop, should be based on a legume such as field pea for winter growth or cowpea for summer growth. The field pea can be sown mixed with wheat, oats or barley and the cowpea with maize, millet or Sudan grass to increase the bulk of organic matter to be turned under.

Farmyard manure and leguminous green manures possess considerable value as fertilizers in addition to providing organic matter from which the supply of soil humus is maintained. The benefits accruing from their use, however, should, as suggested, be supplemented by a planned rotation. In the case of soils which have suffered from intensive cropping, this should preferably be one in which pastures are included for a period of not less than 3 years. A dense vigorous cover of grass will do much to restore soil fertility.

For rotations in general, lucerne is an excellent crop to rotate with potatoes, many farmers practising with success a lucerne, potatoes, green manure, potatoes, pumpkins and lucerne sequence of crops. In the Lockyer the lucerne is commonly sown for 4 years followed by 4 years' cropping with the other crops mentioned.

The potato is a gross feeder and makes heavy demands on the plant food reserves in the soil. Hence fertilizer and lime applications are now commonly practised in all potato growing districts.

Lockyer and Fassifern Valleys

In the Lockyer and Fassifern Valleys, potatoes are grown on alluvial soils of inherently high fertility (Plate 1). Nevertheless, many years of intensive farming have depleted the supply of essential plant foods and heavy fertilizer applications are now commonly made as being necessary for high yields. Generally a mixed fertilizer of the approximate composition 5:13:5 is applied at planting at the rate of 2 to 3 cwt. to the acre. This planting application is often followed by a single side dressing, during the growing period, of a nitrogenous fertilizer at the rate of 1 to 1½ cwt. to the acre.

Lower Burdekin

From the evidence of field trials, the alluvial soils of the Lower Burdekin appear to be mainly deficient in nitrogen. Applications of 3 to 4 cwt. to the acre of sulphate of ammonia to these soils can confidently be expected, therefore, to give a profitable response.

Other Areas

The alluvial soils of the Logan and Albert Valleys are fairly fertile but, like the soils of

Plate 1

South Queensland Spray Irrigated Potato Crop.

Plate 2

Sebago.

the Lockyer, they would probably show responses to sulphate of ammonia applied at the rate of 2 to 3 cwt. to the acre.

Many of the red volcanic soils of the South Burnett and Atherton Tableland are deficient in nitrogen and available phosphorus, and frequently also in available potassium. It is advisable therefore to use 3 to 5 cwt. to the acre of a complete fertilizer mixture for potatoes grown on these soils. A mixture with the approximate formula 8:10:5 is recommended for general use on them.

On some of the alluvial flats in the South Burnett, potassium may be the chief plant food deficient in the soil, and in these it may be necessary to use only sulphate of potash at the rate of 1 cwt. to the acre after a leguminous green manure crop has been ploughed under.

For the lighter textured alluvial soils of the Brisbane Valley, 3 to 5 cwt. to the acre of a mixture of equal parts of sulphate of ammonia and superphosphate is recommended.

On other areas where the soils are not inherently fertile and are known to require fertilizer, a complete mixture with the approximate formula 8:10:5 should be applied, using 3 to 5 cwt to the acre.

Application of Fertilizers

The fertilizer is normally applied at planting in a band a few inches to the side of the seed, and a little below it. In this position it is readily available to the growing root system. Most of the planting machines now in use have an attachment for this purpose. The potato setts should not be placed in direct contact with the fertilizer because of the risk of injury to the germinating seed.

Side dressings of nitrogenous fertilizers are often made during the growing period of the crop. Experience suggests that these should be applied no later than the early flowering stage.

Lime

Potatoes grow best in slightly to moderately acid soils but can tolerate a fairly wide range of soil acidity. As most of the potato soils in this State are either moderately acid to neutral in reaction, lime is not generally required. Its use may not only decrease the yield but may also increase the incidence of potato scab. Only under very acid conditions, such as occur in peaty soils or in some soils in heavy rainfall areas, would the use of lime be warranted.

Land Preparation

The first ploughing should be to a depth of 6 to 9 in., depending on the soil type. This will ensure that the seed, when planted, will have 2 to 4 in. of worked soil beneath it. The land should be left fallow for at least 2 months before planting, care being taken during that time to deal with any weed growth which may appear. A fallow period of two months or more is particularly important where a non-leguminous cover crop has been turned under.

Plate 3

Exton.

Sufficient time must be allowed for the cover crop residues to rot adequately, otherwise decomposing organic matter may cause a temporary shortage of soil nitrogen available for plant growth. This will result in stunting and yellowing of the following potato crop.

The use of a spring tooth cultivator or other suitable implement will not only deal with weed growth but will ensure that the surface soil is in good condition. Land prepared in this way should at planting time be in satisfactory condition to give a good germination if reliable, selected seed is used.

Varieties

The general characteristics of the potato varieties grown in this State are described in Table 1. The principal commercial varieties are Sebago, which represents about 80 per cent. of the crop, Exton and Sequoia (Plates 2, 3, and 4). These three varieties have achieved and maintained their popularity because of their high yielding ability, good tuber shape, high percentage of marketable tubers and resistance to scab.

Small areas only of most of the older varieties are grown each year. The newer varieties, Crana, Awaba, Walanga and Kennebec, have not shown superiority to the main commercial varieties and small acreages only of these are grown.

In north Queensland, Sequoia generally gives higher yields than Sebago and is therefore more widely grown. Bismark (Plate 5) is another variety which is more popular in north Queensland.

Seed

Seed has to be imported from the southern States for the spring planting in Queensland, as locally grown supplies are unavailable for that crop. Growers are strongly advised to obtain certified seed, which is readily available in the popular varieties.

For the autumn crop, planted during the period January to March, seed is normally retained from the spring crop. The usual practice is to keep for seed the second grade potatoes obtained from the general harvest.

TABLE 1

VARIETAL CHARACTERISTICS OF POTATO TUBERS

Name of Variety	Maturity	Shape of Tuber	Colour of Skin	Texture of Skin	Formation of Eyes	Number of Eyes	Placement of Eyes	Colour of Sprouts
Sebago	Mid-late	Flat, oval	White	Fine, smooth	Shallow set. Pronounced eyebrow	Moderate	Evenly distributed	Pink
Sequoia	Mid-late	Flat, oval	Creamy-white	Fine, smooth	Shallow set. Faint eyebrow	Few	Mostly apical	Green
Exton	Late	Rounded, flat	White	Fine, smooth	Shallow set. Faint eyebrow	Few	Mostly apical	Pink
Bismark	Early	Elongated oval	Creamy-white	Fine, smooth	Shallow set. Pronounced eyebrow	Numerous	Evenly distributed	Purple
Pontiac	Very early	Round	Brown	Fine, smooth	Shallow set	Moderate	Evenly distributed	Red
Kennebec	?	Rounded, oval	Creamy-white	Fine, smooth	Shallow set. Faint eyebrow	Few	Evenly distributed	Green
Monak	Late	Round	White	Fine, netted	Shallow set. Faint eyebrow	Few	Mostly apical	Green
Adina	Late	Rounded, oval	White	Fine, netted	Shallow set. Pronounced eyebrow	Few	Mostly apical	Green
Crana	?	Oval, flat	Pink	Fine, smooth	Shallow set. Pronounced eyebrow	Moderate	Mostly apical	Purple
Awaba	?	..	..	..	..	..	..	..
Walanga	?	..	..	..	..	..	..	..
Factor	Mid-late	Elongated oval	White	Fine, smooth	Shallow set. Pronounced eyebrow	Moderate	Mostly apical	Green
Carmen	Mid-early	Oval	White	Fine, netted	Shallow set. Faint eyebrow	Moderate	Evenly distributed	Green
Katahdin	Early	Rounded, flat	White	Fine, smooth	Shallow set. Faint eyebrow	Few	Apical	Green
Brownell	Mid-early	Round	Brownish-red	Fine, netted	Deep set. Faint eyebrow	Few	Evenly distributed	Pink
Manhattan	Mid-early	Elongated oval	Purple blotched	Coarse, smooth	Deep set. Very pronounced eyebrow	Numerous	Evenly distributed	Purple
Early Manhattan	Early	Round	Purple	Coarse, netted	Deep set. No eyebrow	Moderate	Evenly distributed	Purple
Guyra Blue	Mid-early	Elongated oval	Purple	Fine, smooth	Deep set. Very pronounced eyebrow	Numerous	Evenly distributed	Purple
Satisfaction	Early	Round	Pink	Fine, smooth	Deep set. Faint eyebrow	Few	Mostly apical	Pink
Saranac	Mid-early	Round	White	Fine, netted	Deep set. Eyebrow absent	Few	Mostly apical	Green
Moona	Mid-late	Oval	White	Fine, smooth	Shallow set. Faint eyebrow	Few	Mostly apical	Green
Symington	Early	Round	Creamy-white	Fine, netted	Deep set. Faint eyebrow	Few	Evenly distributed	Red
Gold Coin	Early	Round	Ivory-white	Fine, smooth	Deep set. Faint eyebrow	Few	Evenly distributed	Pink
Dakota Red	Early	Round	Reddish-brown	Fine, netted	Deep set. Faint eyebrow	Moderate	Evenly distributed	Red

Plate 4

Sequoia.

A serious disadvantage of this practice is that it gives no opportunity for selection of seed from the most productive plants. Furthermore, although they may be of desirable size for seed purposes, these second grade tubers may have been borne on unthrifty plants suffering from disease and thus their chances of producing vigorous, high-yielding plants are lessened.

Growers will be fully compensated for the extra time and labour involved in selecting their seed requirements only from healthy plants which produced a reasonable number of tubers, the majority of which were of good type and of marketable size.

The tubers selected for seed purposes should be stored in a cool, well-ventilated shed, and should be spread out in shallow layers to promote the development of short, sturdy shoots which will not rub off readily when handled and which will produce strong, healthy plants (Plates 6 and 7). A further advantage of storing in this way is that the tubers are less likely to rot than when stored in heaps or deep layers, and any which show signs of disease can readily be detected and immediately removed. Only sound, dry, unblemished potatoes should be stored, and these should be treated with a reliable insecticide before being set aside for storage.

Seed for the spring crop may be cut, but this practice is not advisable in the case of the autumn crop, as hot, wet weather is frequently experienced during January to March and consequently cut seed is likely to rot in the ground. Seed should be cut a day or two before planting in order to allow the cut surfaces to dry.

The best manner in which to cut seed potatoes will, in large measure, depend on their size. As a general rule, however, the smaller tubers should be cut in half lengthwise (Plate 8). In the case of somewhat larger tubers the stem end should be cut off at about a third of the length of the tuber, the remaining portion being cut through the centre lengthwise, thus making three portions for planting. Still larger tubers should be cut into four setts of approximately equal size (Plate 9). Very large tubers may be cut into as many as six or eight setts. It has been shown however, that yields will be prejudiced if sett weight is reduced below 1½ oz. Any tubers which are not perfectly sound, or which, on being cut, show a suspicious looking discoloration, should be rejected.

Whether cut or whole seed is used, it is very desirable to plant only "shot" seed—that is, seed which has developed short, sturdy shoots. The planting of "unshot" seed is often responsible for uneven stands, irregular growth and low yields.

The quantity of seed required to plant an acre depends on the size of the seed and on whether whole or cut seed is used. On the average about half a ton of seed potatoes will suffice.

Time of Planting

Growers in potato growing districts of south-eastern Queensland are fortunate in being able to produce two crops a year. The first of these,

Plate 5

Bismark.

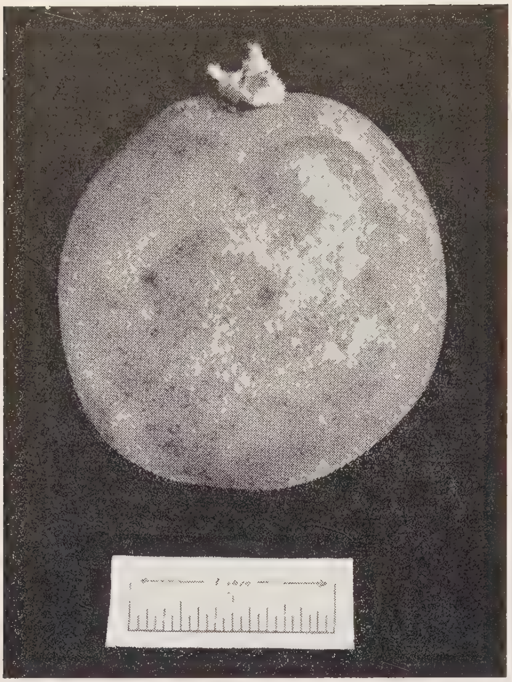

Plate 6

An Ideal Single Sett.

commonly known as the spring crop, is planted during June, July and August, the second, known as the autumn crop, during January, February and March. In districts which enjoy a partial immunity from frosts, plantings are carried out in June, so that the crop can benefit by the cooler temperatures during its growing period. In districts such as the Darling Downs, planting may be delayed until as late as September because of the risk of late frosts injuring earlier plantings.

It is generally recognised that the earlier the spring crop is planted the greater are the chances of a heavy yield, provided, of course, that weather conditions are favourable. A crop planted late in spring may encounter high temperatures and humid weather and tend to produce excessive top growth and a light crop of tubers.

In north Queensland, where only one crop is grown annually, the time of planting is influenced by the incidence of the monsoonal rains, and planting there does not take place until the warm, wet season is over, usually in April or May. Sometimes a prolonged wet season will delay planting until June or even July. Late plantings, however, are not favoured.

Planting

Planting is now almost universally carried out by machine, and the standard commercial potato planter (Plate 10) is most commonly used. In some cases, however, modified planting attachments are fitted to the three-point linkage cultivator. These machines, which plant two or more rows at a time, require in addition to the tractor driver, one operator for each row being planted.

The seed potatoes are spaced at an even depth and distance apart, the usual distance between them in the furrow being 12 to 15 in. with a planting depth of 5 in. The distance between rows is generally 30 to 36 in. With modern planting machinery, planting and covering are carried out in one operation.

On the Lower Burdekin area wider row spacings, up to 42 in. are used to permit the

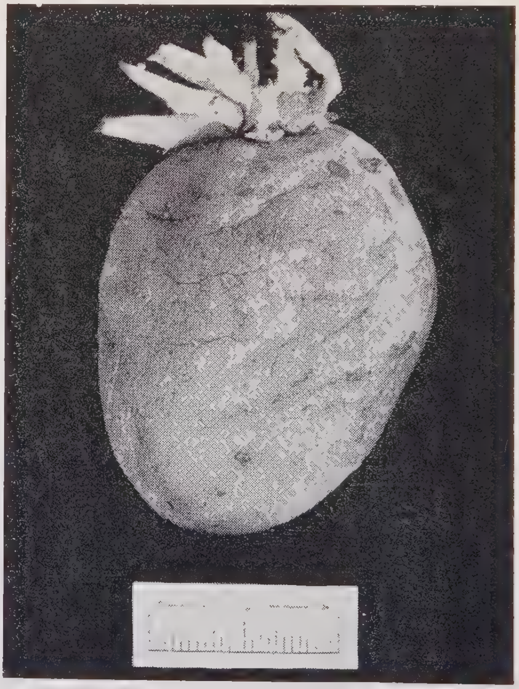

Plate 7

Weak, Easily Damaged Shoots, the Result of Insufficient Light.

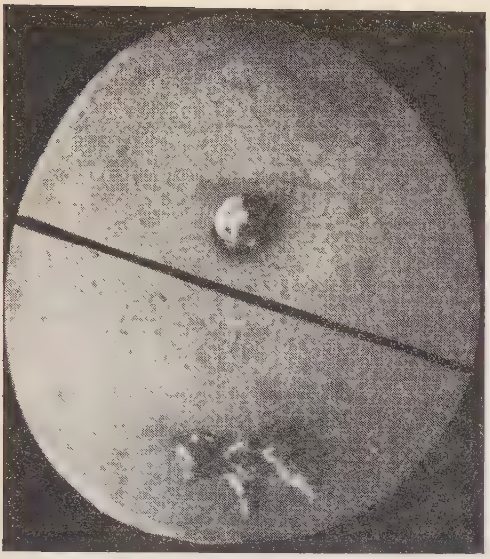

Plate 8

Tuber Suitable for Cutting into Two Setts as shown. Note the short, sturdy shoots, the result of exposure to light.

crop to be hilled up effectively under furrow irrigation. The normal sett spacing there is 10 to 12 in.

Crop Cultivation

The first cultivation should be carried out as soon as the plants appear above ground. A light tine harrow, preferably a lever type with the tines set slightly back, is the most suitable implement for this purpose. This cultivation will not only break up the surface soil which may have become slightly caked as a result of rain or irrigation following planting, but it will also destroy any weed growth which may have sprung up between the plants. This is the best opportunity for eradicating the weed growth, as all subsequent cultivations can be carried out only between the rows. The number of inter-row cultivations will depend on seasonal conditions, and, in the case of irrigated crops, on the number of irrigations and the method used, whether spray or furrow. Cultivations should be sufficient, however, to keep weed growth in check and at the same time keep the surface soil in a friable condition. Care should be taken to adjust the implement so that the tines do not damage the roots of the plants.

As the plants approach the flowering stage they should be hilled. It should be the practice with each successive hilling operation gradually to hill up the soil about the plants to an apex formation. The main advantages to be derived from hilling are that it prevents tubers, which might otherwise have been exposed, from becoming discoloured, and it also affords some measure of protection against the potato tuber moth.

Modern light tractors can be fitted with various sets of implements for cultivating and hilling potatoes speedily and efficiently.

Irrigation

Potatoes require ample moisture for satisfactory growth and in most districts respond well to irrigation. Irrigated crops produce both higher yields and tubers more uniform in size and quality than do rain-grown crops. Water should be applied in sufficient quantities to keep the plants growing evenly without stress periods. Water requirements are greatest during the period of tuber development, which is from the flowering stage until near maturity. During this period the

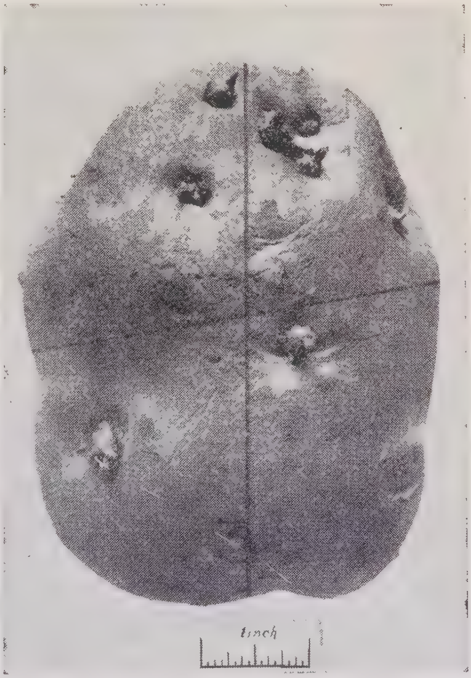

Plate 9

Tuber Suitable for Cutting into Four Setts.

soil should be kept moist, for if it is allowed to dry out and then watered, the tubers are likely to sprout and develop second growth.

The amount of water to apply at each watering and the number of waterings will vary with soil type and seasonal conditions, but the total water requirements of a potato crop in south-eastern Queensland in rainfall and supplementary irrigation will generally be in the vicinity of 17 in. Light textured soils require light waterings at fairly frequent intervals during dry periods; heavier soils can absorb more water and may be irrigated more heavily at less frequent intervals. The amount of water applied should always be sufficient to wet the soil within the root zone of the plant. One to 2 in. at each application is usually sufficient for light soils while 2 to 3 in. may be required for soils in the clay loam class. There is a tendency among growers in the Lockyer to give lighter, more frequent irrigations.

Either spray or furrow irrigation may be used, the choice of method being influenced mainly by local circumstances. Occasionally, a combination of both methods is found to fit in satisfactorily with farm routine and the grower's labour supply. In this case, the common practice is to use spray irrigation for the establishment and early growth of the crop and carry out furrow irrigation in the latter stages.

In the Lockyer and Fassifern Valleys, spray irrigation (Plate 1) is favoured, but on the Lower Burdekin, where large supplies of irrigation water are available, the furrow technique (Plate 11) is mainly adopted.

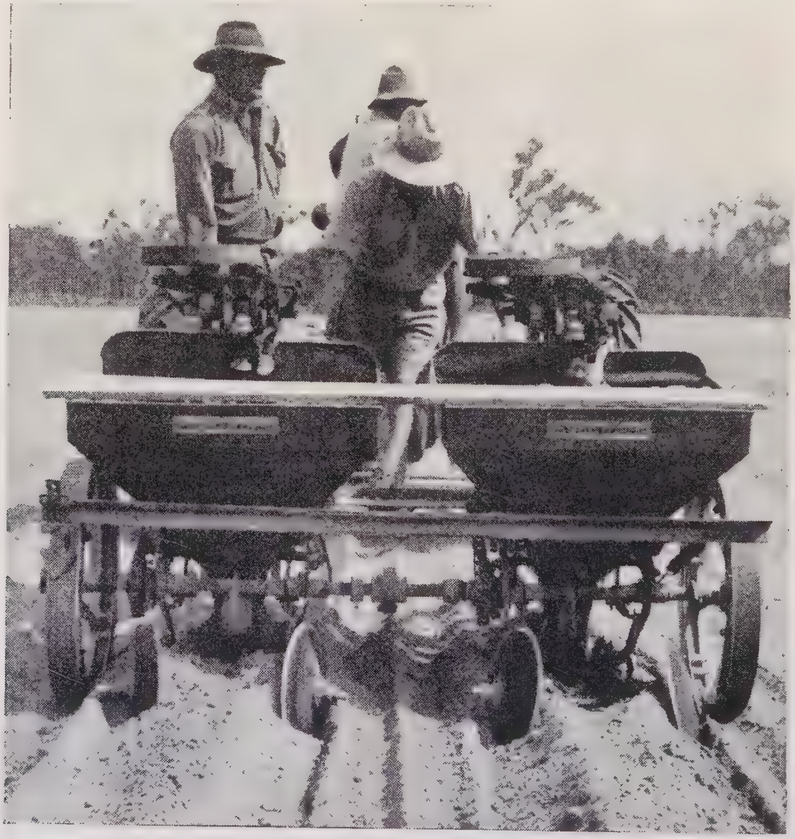

Plate 10

A Two-row Planter. The view shows the method of planting and hilling potatoes on the Lower Burdekin.

Plate 11

A Field of Furrow Irrigated Potatoes of the Variety Sebago on the Lower Burdekin. The seed was planted 11 weeks previously.

Harvesting

Harvesting, in the case of the spring crop, is usually carried out as soon as it can be undertaken safely. The hot, stormy weather normally prevailing when the spring crop is due for harvesting, and the risk of damage by the potato tuber moth, which is then particularly prevalent, make it necessary to harvest the crop as expeditiously as possible.

It is not advisable, however, to dig the potatoes before the skins are firm, because immature potatoes are likely to arrive on the market in a badly rubbed and damaged condition.

As the autumn crop ripens during the cooler months of the year, the tubers may be left much longer in the ground after the crop has ripened than is the case with the spring crop, and, if desired, digging need not be carried out until the tops have completely dried out.

Harvesting is carried out with mechanical diggers. Both the spinner and the elevator (Plate 12) types are used. These do good work in clean crops and on loose friable soils, but are not so satisfactory on the heavy soils. Farmers on the alluvial soils of the Lockyer Valley favour the elevator type of digger in preference to the spinner type.

Most mechanical diggers leave the potatoes on the surface of the ground, but recently potato harvesters have been built which dig the potatoes and provide for sorting and bagging. For effective working these harvesters require, in addition to the tractor driver, four operators to pick and sort the potatoes and sew the bags. Frequently, in heavy-yielding crops, more than four operators can be usefully employed.

The tubers, after being dug, should not be left exposed to the hot sun for any length of time, but they should be bagged and removed from the field as quickly as possible. Furthermore, the bagged tubers should on no account be covered with potato tops while standing in the field, as this is one of the surest ways of introducing the tuber-moth pest to the bagged tubers. The harvested tubers can be protected from infestation by this pest by treatment with insecticidal dusts.

Grading and Marketing

When preparing tubers for market they should be carefully graded to conform with regulation standards of maturity, size and freedom from blemishes. Care should be taken to reject any tubers which are damaged or show signs of potato tuber moth infestation, and on no account should bruised tubers or tubers with dirt adhering to them be included when bagging. The tubers should be packed firmly in the bags, but not too tightly, as such tight packing is likely to cause bruising, which will be followed by decay. Too loose packing is equally objectionable for the same reason.

Grading of potatoes is compulsory and no person may sell or offer for sale in Queensland any potatoes which do not comply with the fruit and vegetable grading and packing regulations of *"The Fruit and Vegetables Acts,* 1947 *to* 1959."

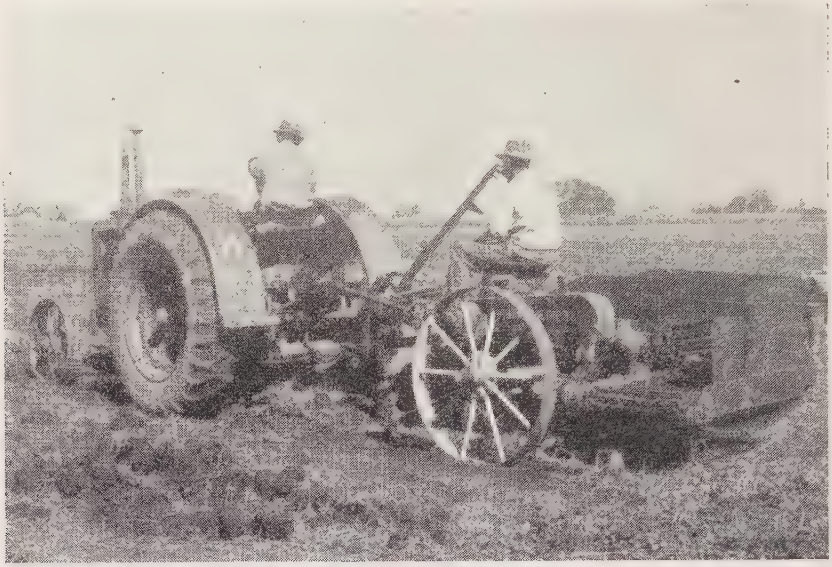

Plate 12

A Side Delivery Elevator Type Potato Digger at Harrisville.

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Tractor Tests

I think you will agree that the purchase of a new tractor is an important event in the life of any farmer. Also of equal importance is the final choice of the most suitable tractor for your particular requirements.

In the United States prior to the inauguration of the American Nebraska tractor tests, farmers were sometimes the victims of high pressure salesmen who sold them tractors which fell far short of the performances claimed in the sales literature.

Other countries were quick to follow the example set by the State of Nebraska, and whilst the Australian Tractor Testing Scheme is based on the Nebraska tests it differs in many respects. First and foremost it is entirely voluntary and there is no law requiring a tractor to undergo test; that is why it is sometimes impossible to comply with farmers' requests for copies of test reports on particular models. In such cases, the manufacturers or distributors have not presented those models for formal test.

To ensure that more tractor models are tested, farmers should insist on seeing the test report of the Australian Testing Committee before deciding on the purchase of any particular make or model of tractor.

It must be borne in mind that any overseas test reports available do not necessarily reflect the capacity and performance of the same model available in Australia. Very often, for example, the Australian model has a modified engine, a significantly different weight, different wheels and tyres and of course operates on Australian fuels which might differ from those used in overseas tests.

For the price of a stamp, you can get this valuable information; copies of all test reports published by the Australian Tractor Testing Committee are obtainable free of charge from the Agriculture Department.

—*C. G. WRAGGE, Agricultural Engineer.*

TRICHOMONIASIS

A Cause Of Infertility In Cattle

By A. R. McTACKETT, Husbandry Officer.

The three major infectious diseases causing infertility of cattle are brucellosis (contagious abortion), vibriosis and trichomoniasis (pronounced tri-ko-mon-i-asis). Of the three, trichomoniasis is the least common in Queensland. Its main points, including treatment and control are discussed in this article.

The disease was first recorded in a dairy herd in the Moreton district in 1950. Subsequently, it was diagnosed during the years 1952 and 1953 but no further outbreaks were recorded until 1950-60.

Bovine trichomoniasis (for which there is no common name) is a specific venereal disease of cattle caused by the protozoon * *Trichomonas foetus*. It gives rise to service return in cows, foetal and embryonic deaths, early abortions and pyometra (pus in the uterus). The infection is generally permanent in bulls but due to the development of local immunity it is usually self-limiting in cows.

Since it was first found in France in 1888, *Trichomonas foetus* has been reported from all continents. Its distribution is world-wide, being most common in areas of intensive dairying, although affected beef herds have also been found.

Trichomonas foetus is a parasitic protozoon which lives only in the reproductive organs of cattle. Its life history is not completely known. Several different strains of the organism have been isolated. Of these, the less virulent ones commonly produce abortion and pyometra because of their slower action.

How it is Spread

Under natural conditions the only method of transmission is by service, during which the organism passes either from the bull to the cow or vice versa. The bull is responsible for the spread of infection but is himself infected from a cow in the first instance. The *site of infection* is always the genital organs.

In bulls, *Trichomonas foetus* lives only on the lining of the penis and sheath, where it will remain indefinitely. Trichomonads have been found in the upper reproductive tract but only on very rare occasions.

The initial site in the cow is the vagina but the uterus is the main persistent site of infection. In some instances infection may persist in the vagina. Usually when the organisms are deposited in the vagina at oestrus they invade the uterus through the relaxed cervical canal. This occurs following service by an infected bull. The first third of the uterine horns offers the best environment for their continued growth.

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* For definitions of technical terms, see end of article.

The vagina quickly develops a local immunity which results in the death of organisms present in the passage; it is therefore an unreliable source of Trichomonads.

The organism may invade the tissues of the developing **calf** and the membranes in which it is enclosed within the uterus.

Persistence of Infection

As a rule, infection in bulls is permanent, although natural recovery has been suspected in very rare instances. *T. foetus* is passed at practically every service. In chronic infections, it is difficult to find the organisms in bulls despite their recurrent transmission at service.

In cows, the time taken for natural recovery varies considerably. A sexual rest of 90 days or three heat cycles is considered sufficient in most cows. In the first recorded outbreak in Queensland, infection in the uterus persisted in one case for 19 months after its first detection and another for at least 8 months. Both these cows remained sterile and had to be slaughtered. Samples taken from the uterus of each cow after slaughter indicated both were still carrying infection.

As infection in bulls is of indefinite duration, they must be regarded as permanent **carriers.** Carrier cows exist, probably less than 1 per cent., but little other evidence exists that cows harbour and spread infection for long periods especially if they conceive and carry the calf to full term. Persistent infection of the vagina is extremely rare.

There is no evidence that bulls develop immunity. Cows develop a local immunity and may remain resistant to infection for one or several years. The duration of immunity in individual cows is, however, unpredictable. During this time they may reproduce normally even if served by infected bulls. However, young stock entering the herd and introductions from outside the herd continue to be troublesome.

Symptoms in Individual Animals

Only during the acute stage of infection are symptoms likely to appear in bulls. There may be a slowness or unwillingness to work, accompanied by discharge from the sheath, nodules on the penis, and local swelling and inflammation of the sheath.

Many bulls may not even display these symptoms which will pass unnoticed to the chronic stage when no observable evidence of the disease exists. Often it is thought that the bull is infertile. Actually, his fertility is unaffected (unless orchitis develops) even during the acute stage. His failure to establish pregnancy is due to the presence of infection in cows.

In cows, service return is the first obvious sign. The initial vaginal discharge usually passes unnoticed. If noticed, its significance is overlooked and it is soon forgotten.

Early abortion between the first and sixteenth week is easily missed. The outstanding feature is irregular heat cycles. Abortions may occur at any stage of gestation, chiefly during the first half. Later abortions are rare.

After abortion of the calf within its membranes, a period of temporary infertility usually ensues; a few cows may, however, quickly conceive and carry the calf to term. Post abortion symptoms are usually very slight and it is an advantage in diagnosis to refer any discharges at any time back to the last service date.

When abortion occurs but cows fail to clean or when the foetus dies and is not expelled, pyometron may follow. Permanent sterility may then result from damage to the lining of the uterus.

Herd Symptoms

It is unusual to get a clear picture of the disease in a herd. No symptom is reliable or specific enough to allow positive diagnosis, especially as similar symptoms occur with vibriosis. The course of the disease coupled with a typical history and the manifestation of a herd problem are strong pointers to *T. foetus* infection.

Symptoms of utmost importance in leading one to suspect trichomoniasis are:

1. When a number of cows or heifers unexpectedly return to service after being considered in early pregnancy.
2. When most of the herd require several services before pregnancy is established, or when persistent failure to conceive with irregular oestrual cycles occurs.
3. When cows hold to service relatively easily but heifers continue to return, indicative of long standing infections.

4. When there are no noticeable symptoms associated with the bull, except that cows are not holding to service.
5. When abortions occur during the early stages of pregnancy, usually between 3 and 16 weeks.
6. When vaginal discharge of an odourless mucopurulent nature referable to a previous service occurs.
7. When pyometron occurs.

Course of Trichomoniasis in Herd

The different symptoms often observed in an infected herd can be more clearly appreciated by studying the course of the disease after recent infection. Herds infected for some time may contain cows at different stages of infection with symptoms varying from slight to severe.

(i.) *Acute Stage.*—During the initial stage of infection the conception rate is not markedly affected. Cows are apparently in calf and unexpectedly return to service. In some instances, death of the embryo occurs at 6 to 12 weeks, followed by abortion at 9 to 15 weeks. In others, cows return to service at 3 to 5 weeks without signs of abortion.

(ii.) *Chronic Stage.*—The second phase of infection is marked by a low conception rate and regular returns to oestrus. *T. foetus* produces an inflammation within the uterus. Endometritis prevents fertilization and attachment of foetal membranes. Continuous or occasional discharges characterise this stage during which vaginal re-infection from the uterus may occur.

It is during this chronic stage that foetal death is more common, especially during the fourth or fifth month of pregnancy. Abortion or retention of the foetus then occurs.

Pyometron is a common sequel to the retention of the dead foetus, including the cervical plug and *corpus luteum*. This may not be detected till full term. The fluid is characteristically thin, like sour milk, and may vary in amount from a few drops to 25 gal. These two phases usually last from 9 to 18 months.

(iii.) *The recovery phase* begins as local immunity develops in the herd. With strengthening immunity conception rate improves. Abortions are rare. Normal pregnancy and calving occur despite infection. Some cows remain sterile due to incomplete recovery of the lining of the uterus or to persistent infection.

Finally, herd fertility is restored to a reasonable level despite the continued presence of infection. Sterile cows must be sold for slaughter to reach this stage as infection may persist in a few cows for over 18 months.

During the various phases, the bull may infect susceptible cows and heifers entering the herd. These cows will be passing through the acute stage while the rest of the herd is in the chronic or recovery stages. Upon re-infection after recovery, cases of pyometron are more common. However, complete elimination from a herd is most unlikely unless adequate control is exercised, particularly with regard to bulls and mating practices.

The course of infection in bulls shows only two phases, acute and chronic. Spontaneous recovery is very rare. Infection persists indefinitely.

Diagnosis

Positive diagnosis of trichomoniasis depends upon demonstrating the presence of the free motile *T. Foetus* in vaginal mucus from cows or sheath washings from bulls. This involves the use of a microscope.

It must be stressed that the demonstration of the organism in vaginal mucus depends primarily upon the time when the sample is collected. The primary site of the organism is the uterus. The failure to find *T. foetus* in vaginal mucus does not necessarily mean that the animal is not infected. Positive diagnosis in bulls from sheath washings is even more difficult unless bulls can be sampled regularly over a period or test-mated with virgin heifers. At best, present methods of diagnosis fall far short of 100 per cent. because affected animals may escape detection.

Other Diseases

The chief diseases likely to be confused with trichomoniasis are:—

1. *Brucellosis.*—Although brucellosis is widespread and the cause of much infertility in Queensland herds, it is a mistake to blame it exclusively. Trichomoniasis and vibriosis have

each been found in Brucella-infected herds. The general symptoms of late abortions, dead calves and retained membranes in a herd point to brucellosis. Blood tests will confirm the diagnosis.

2. *Vibriosis.*—The disease most likely to be confused with trichomoniasis is vibriosis. Clinically, the two diseases resemble each other. In the chronic phase, oestrual cycles tend to be more irregular in vibriosis than trichomoniasis. Abortion in the middle third of gestation is more typical of vibriosis, but service return is often marked in the initial stage. A copious discharge of clear or brownish-tinged mucus within 48 hours after service has been noted in some *V. foetus* infected herds. Positive diagnosis depends upon laboratory tests carried out on vaginal mucus collected from infected cows.

3. *Pyometron.*—There are various other causes of pyometron, the most common being secondary bacterial infections.

4. *Vaginitis.*—Several types of inflammation of the vagina occur but their significance in infertility is not fully known. Often vaginitis is a symptom of other disease.

5. *Sterility in Bulls.*—This should not be overlooked and some effort should be made to assess the bull's part in breeding troubles. However, it is unwise to change bulls until adequate tests have been done for trichomoniasis and vibriosis, because new bulls inevitably become infected if these diseases are present.

Treatment and Control

There is no reliable treatment yet available for either bulls or cows. Control of the disease is therefore based on the immunity developed by the cow and the disposal for slaughter of all infected or suspect bulls.

The ideal method for the control and eradication of the disease is artificial insemination. To ensure freedom from infections, bulls in A.1. centres are examined for trichomoniasis and other diseases before being put into service. Where A.1. is available, the spreader of infection, the bull, is eliminated and the link of re-infection broken. Even so, it may be necessary to cull cows for failure to conceive because of persistent infection.

Control and eradication of the disease using natural service requires more time and there is the ever-present risk that unscheduled service may occur causing a breakdown in the control. To be successful the programme of control must be rigidly adhered to. The first and most important essential is to have bulls confined in paddocks from which they cannot escape.

Two bulls are usually necessary in a safe eradication campaign.

One of these is used as a sacrifice bull and is mated only to cows that have failed to conceive at the beginning of the control programme. Cows that are not in calf at the beginning of the period of control are given a sexual rest of at least 90 days or 3 heat periods before being mated to a clean sacrifice bull. All these cows must conceive and carry their calf to full term before they are mated to a clean bull that may be retained. Those cows that fail to conceive must be sold for slaughter. When the bull has completed this programme he should be sold for slaughter because of the risk that one or more of these cows have failed to throw off infection during the period of sexual rest.

In herds where only a few of the cows are empty at the beginning of the programme, serious thought might well be given to their disposal before mating is resumed. This eliminates the cows that are most likely to infect bulls.

Cows that are in calf at the beginning of the control programme should not be mated for at least 90 days after they calve. When they conceive these cows may be regarded as free from infection. Cows that have conceived and calve from the original empty group may also be mated to this bull following the 90-day sexual rest after calving. On conception they too may be regarded as free from infection.

This programme is based on the latest recommendations from a committee of the Food and Agriculture Organisation of U.N.O. which has carried out intensive studies of trichomoniasis. It will be readily appreciated that utmost care must be taken to keep straying stock, especially bulls, off the property for they can soon nullify attempts to control and eradicate the disease.

Trichomoniasis is a notifiable disease and its presence in a herd leads to quanantine. The disease is not prevalent in Queensland and because of the serious effect it has on herd fertility the placing of quarantine restrictions on affected properties is necessary to prevent further spread of infection.

The greatest care should be taken in the purchase and introduction of stock into a herd. This applies particularly to bulls. Introduced bulls that are suspected of being infected should be test-mated with 6 virgin heifers under veterinary supervision and certified free before being put into service in the herd. This method of test-mating safeguards against the collapse of the herd breeding programme due to the introduction of trichomoniasis in purchased bulls.

DEFINITIONS

In describing a disease such as trichomoniasis, some technical terms have to be used. The following explanations are provided.

Cervical plug—a thick, sticky substance (similar to thick glue) which seals the entrance of the cervix following conception.

Conception—the union of the sperm of the male with the egg or ovum of the female to form a new life. This occurs within two days of an oestrual or "heat" period during which the cow has been served by a bull or artificially inseminated. "Fertilization" is another term used in place of "conception". The fertilized egg attaches to the wall of one of the horns of the uterus and then proceeds to grow.

Conception rate—Percentage of cows conceiving at first service.

Corpus luteum—a yellow body formed in the ovary of the female following pregnancy. Normally, oestrus does not occur while the "yellow body" remains in the ovary.

Embryo—the product of conception up to the fourth month of pregnancy.

Endometritis—inflammation of the mucous membrane lining the uterus.

Foetus—unborn offspring in the later stages of development. There is no clear point of time when an embryo becomes a foetus but the embryo is the early stage and the foetus the later stage of development of the unborn calf.

Foetal membranes—commonly called "afterbirth" or placenta.

Genital organs—the organs of reproduction.

Infertility—failure of the animal to breed. In the case of the cow this also includes failure to have "heat" periods (anoestrus).

Metritis—inflammation of the mucous membrane lining the uterus.

Mucosa—mucous membrane, a thin layer of tissue surrounding or lining an organ.

Mucopurulent—consisting of both mucus and pus.

Oestrus or heat—a condition of the cow when she will receive service from the bull. This occurs every 18-21 days in the case of a normal cow which is not-in-calf. Pregnant cows do not normally exhibit oestrus, and failure to do so following service is regarded as the first symptom of pregnancy. The period of 18-21 days is referred to as the length of the oestrual cycle.

Orchitis—inflammation of the testicle.

Pregnancy—the period during which a cow is "in-calf". A normal pregnancy (gestation period) is about 40 weeks or 282 days.

Protozoon—a lowly form of animal life, not visible to the naked eye in the case of *Trichomonas foetus*.

Pyometron—a collection of pus in the uterus.

Uterus—the womb or "breeding bag". This organ contains the developing calf from the time of conception until it is born or pregnancy is ended in some other way.

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GULLY STABILIZATION: Many of the natural water disposal systems in Queensland's agricultural districts are unstable and have been replaced by gullies. This situation can be corrected by firstly shaping the gully to a rounded section and then establishing a sward forming grass like kikuyu.

But the grass does not provide effective protection until it has formed a sward and developed an extensive root system. In the meantime, it may be washed away unless special precautions are taken.

These precautions involve the use of mulch, netting and asphalt emulsion to provide an erosion resistant barrier over the strips of grass. The growth of grass is stimulated and very successful results have followed this approach particularly if applied in July when there is less risk of major runoff flow.

—*J. E. LADEWIG, Chief Soil Conservationist.*

THE DINGO

Its Habits And Control In Central Western Queensland

By G. LE GROS, Sheep and Wool Adviser.

Three hundred and thirteen dingoes caught in 12 months! This is the tally for two dingo control syndicates and one private property in the Blackall and Yaraka districts last year. No wonder dingoes are considered such a menace by sheepmen in the "doggy" areas of the central west. They have been a major problem for many years on the marginal sheep areas which front the cattle country. It is here that these wild dogs are continuously striving to gain entrance into the sheep country through dog-netting fences which border the cattle country.

Professional dogger, Jim Davie, remembers a red dingo which killed over 500 lambs on "Smith's Lagoons", north of Yaraka. "I spotted the dog killing lambs in a mob of ewes and lambs coming out from water," he said. "In the short space of time it took me to line up my gun sights on this killer and shoot him, he had killed three small lambs." Jim Davie also recalls two such killer dogs which accounted for 30 odd sheep a night on "Isis Downs" in 1924.

On "Lisburne", a sheep property 75 miles south of Blackall, Jack Treasure recalls a dog which killed about 20 sheep each night until caught.

These are just a few examples of the menace of dogs (as dingoes are more commonly called) in the sheep country. Killer dogs and well-grown pups kill for sport. They bite many sheep which subsequently die from infection o fly strike.

Kangaroos, emus, rabbits, lizards, calves an weak cattle are the usual prey of dingoes in the cattle country. In these areas dogs often kill large numbers of calves and weak cattle, particularly in very dry times. With the present cattle prices this can represent a substantial financial loss. For this reason alone, the dingo would appear a sufficiently serious problem for cattlemen to apply more positive control measures.

Inside the sheep areas, dogs tackle the easiest prey—sheep. Once dogs have killed sheep, they rarely change from this diet while in sheep country. Fortunately, killer dogs are the exception rather than the rule. These killers and "playful" well-grown pups can account for heavy losses of sheep in a few days. The average dogs kill only to eat. Apart from the sheep killed, a further loss results from dog bite.

Hunted dogs in sheep country kill about once a day. They seem to show a preference for strong healthy sheep and they like fresh killings. These hunted dogs never return to the remains of their kill, and for this reason it is useless to bait inside sheep country when dogs are killing sheep.

Baiting outside sheep country is quite successful and skilled baiting of brumby carcasses has often resulted in success. Observations have shown that the entire baited carcass has been eaten, so that in cattle country this can be a means of baiting many dogs. Strychnine baiting of brumbies outside sheep country has been observed to be even more effective in good years than bad, as the natural prey of dogs in good years is strong and much more difficult to catch.

Habits

Dingoes mate once a year about April and May, and pup about 63 days later. In contrast with the regular yearly pupping of the uncontrolled domesticated bitch, many dingo bitches have been caught from year to year in July and August showing no signs of reproduction.

Dingoes prefer to burrow deep into the ground to form their "nest" for pupping. These nests are similar to fox burrows but are bigger.

In the hilly country of the Blackall-Yaraka districts, they usually burrow under rocks, or use caves.

These nests are often found in close proximity to water, but some have been found many miles away. Occasionally a bitch will select a hollow log as a nest.

The average litter numbers from five to seven. On one occasion on "Bellevue," Yaraka, in 1927, dogger Jim Davie caught 15 pups in one nest.

Plate 1

A Dingo in a Trap at Collabra Station in the Blackall District.

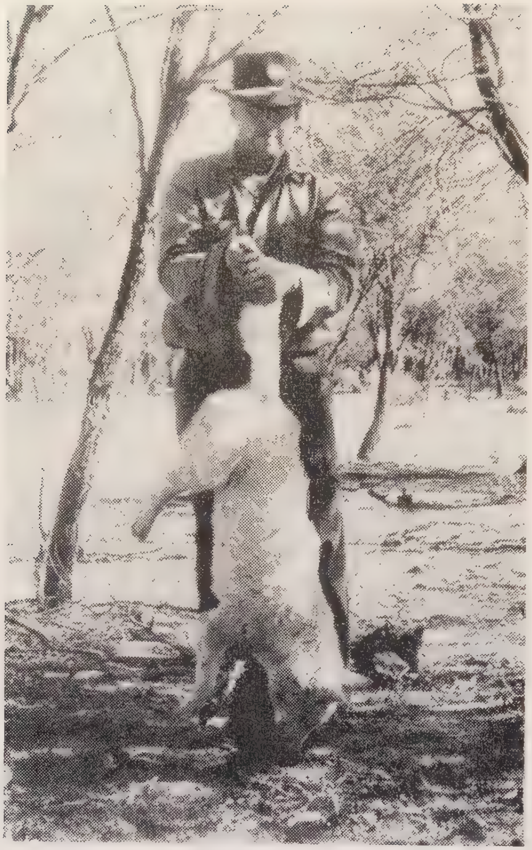

Plate 2

A Dead Dingo.

Tracks are plentiful around the nest and lead in from a well-defined pad or pads. The nest and pups' playground soon become littered with bones and pieces of hide, the remnants of parent dog kills.

These remains often attract hawks and crows, which together with the multiple tracks, provide a helpful guide to the nest in rugged hilly country.

Experienced doggers find dingoes easier to catch during the mating season, whilst during the rest of the year the inexperienced pup is easier to catch than the older, experienced dog.

Control Measures

Control measures adopted in the central west are:

(i.) Dog syndicates

(ii.) Private control areas

(iii.) Professional doggers

(iv.) Dingo bonuses.

These measures operate as follows:

(i.) Syndicates consist of a group of graziers who construct and maintain a dog-netted fence which encloses their sheep properties, or fronts the "doggy" country. These syndicates usually employ a full-time dogger, and pay a substantial bonus for dogs caught inside the netting, and a lesser bonus for dogs caught outside.

A typical syndicate about 35 miles east of Blackall has a 30 mile dog-netted frontage onto the cattle country, which lies to the north and east. There are 14 properties in this syndicate, which employs a full-time dogger, who caught 138 dogs last year. Of these, 48 were caught inside the fence and 90 outside. The dogger in this syndicate is paid a salary, a bonus for dogs caught, and is supplied with all necessary plant, including a vehicle, traps, poison, and petrol. Some of the properties inside this syndicate also carry out some dingo control of their own. Such is the case on "Tralee", where Mr. Bob Treasure is constantly on the lookout for fresh dog movements. He assists the syndicate dogger with trapping on "Tralee", and in the past has shot a number of dogs himself. The bonus paid in this syndicate is £10 for dogs or pups caught inside the area, and £2 10s. outside, and each scalp also attracts a local authority bonus of £1. No control measures are put into effect on the adjacent cattle country, other than annual aerial baiting. During the last three years, the colour of dogs caught in this area was, in order, brindle, red, black and tan, and creamy.

(ii) Control of dingoes in the marginal areas is of paramount importance, because it is here that dogs enter from the cattle country. There is a continuous pressure of dogs and an unending control programme has to be adopted. One such marginal area is "Lisburne", a rugged 60,000 acre sheep property 75 miles south of Blackall. Dogs have been a problem since Mr. S. A. Treasure first ran sheep there in 1924. Jack Treasure, the present manager, gives three main reasons why dogs are difficult to control on his property:

(*a*) Nature of the country. This property is very rugged and affords protection for dogs, and is also difficult to patrol and trap.

(*b*) Fence maintenance. As flood run-off from the hilly country can be quick, severe damage often results to the dog netting fences.

(*c*) No outside control of dogs.

Private control measures used successfully on "Lisburne" are: Firstly, effective dog netting fences, frequently patrolled for breaks, with immediate repair to keep it wholly dog-proof; secondly, trapping dogs which intrude inside the netting, and trapping outside (in the last 5 years, 43 dogs were trapped inside, and over 200 outside the netting); thirdly, poisoning has been found particularly effective in the spring. It is then that the young dogs are starting to fend for themselves and they are less wary of baiting than old dogs. Trap guns were used with success until they became illegal.

(iii.) Mr. Jim Davie is a particularly effective dogger employed by the Yaraka Dingo Destruction Syndicate. This syndicate comprises 21 properties with a total area of over 1 million acres. It has about 70 miles of dog-netting fence, fronting the cattle country. When a dog is reported inside the netting, the dogger goes to the area as soon as possible and traps. At other times trapping is carried on by this dogger outside the netting in the cattle country. He has had a lifetime of experience.

The numbers of dogs caught last year were 24 inside the netting and 101 outside. In a little over 6 years, 689 dingoes have been caught, and of this catch the colour predominance was as follows: black and tan, red, creamy, and brindle.

Dingo bonuses of £1 a head are paid by local authorities to any person on presentation of scalps. The scalp has to comprise a strip of skin from the nose, head and back, and must include the tail.

Aerial baiting is a very controversial subject in these doggy areas.

Proven Methods of Control

Dog-netting Fences.—Proper construction and thorough maintenance of dog-netting fences has shown proven results. A well-patrolled dog-netting fence has kept out most dogs. However, kangaroos, pigs, emus, flooding and cattle have been responsible for damage to dog netting, and dogs have gained entrance through these areas before the damage was observed and repaired. An exceeedingly cunning dog has been known to burrow its way under a fence, but fortunately this is not common.

Trapping.—Every dingo trap should be set to catch the cunning dog. Dogs that escape become exceedingly difficult to trap again, and to eliminate possible escape, every effort should be made to make a trap as near perfect as possible. Inexperienced trapping breeds cunning dogs.

When to set.—Tracks indicate the presence of dogs. Graziers in danger areas should be ever watchful for tracks. Experienced men observe fresh movement of dogs and soon know when a dog is inside the netting. At this stage, control measures must be adopted. If possible, sheep should be moved to another netted area, as the dogs will be killing, and the sheep may also foul traps. If it is not possible to move sheep, then traps can be set in areas frequented by dogs and not sheep.

Where to set.—Whilst there are numerous sets (a place where a trap is positioned) which have produced results, Dogger Jim Davie does not believe in setting on pads or in gullies. He believes in using a decoy to "call a dog off a pad." Using a domestic dog, he determines where it leaves a pad to urinate, or dung. This spot is also attractive to dingoes, and if dingoes are running in this area, he sets traps at such spots. Most of the 689 dogs caught by Davie in the last 6½ years were caught in such a manner.

He states, "It is useless to trap in sandy gullies, as rain can cover the trap heavily with sand and render it useless. Set traps off to one side where a dog will go to scratch. You don't want stock, kangaroos and such like springing the traps. I've found that the only animals attracted to a decoy set are dogs (dingoes and domestic), foxes and an occasional tomcat. Accidental trapping of other animals does happen occasionally."

It is very important that the set trap will be capable for many weeks of catching dogs for the very obvious reason that big areas are trapped by one man and it is not only impossible but very undesirable to pay repeated visits to the sets. To give an idea of the magnitude of the task, 30 odd traps set over an area of 50,000 acres can be considered intensive trapping outside the netting in cattle country.

A very cunning dog requires a different set. It will shy off decoys, or any strangeness around a set (such as a stick used to break the dog's stride). For these dogs, which are usually inside and killing sheep, Dogger Davie remarks, "I prefer a pad set for a bad dog. I don't use a decoy, or move any of the natural surroundings, and I always approach the set from the side of the pad, so that the dog will not come in contact with man smell before reaching the trap."

The Trap In the setting of dingo traps many variations are used to ensure that even after being trapped the dog will not escape. Dogs have been known to free themselves by chewing through the skin and sinews of their leg at the point where the bone has been broken by the trap. To prevent this, the jaws of the trap should be poisoned.

A piece of rag 6 in. square should be wrapped around the loose jaw of the trap a few times, and in the last wrap, and on the outside, a teaspoon of strychnine should be added. In this manner, a dog will be quickly poisoned when it bites at the trap.

A variation of this poisoning is to fold the piece of rag up, enclosing strychnine in each fold. This is then attached to the outside of the loose jaw. It has been found that while any part of the rag remains on the trap in later use, it is capable of poisoning. This method saves repoisoning at each set.

Eight-inch traps have been found very successful, and the mechanism should be in very good working order. If the trap has been damaged by any cause, it should be properly repaired before use.

When Setting a Trap

1. Place the trap on the ground and cover the plate with a piece of canvas about 12 in. square. Do not use paper because it is not durable enough, and it is necessary for the trap to work successfully many weeks after setting. Canvas will not be affected by rain.

2. Have the loose jaw closest to the operator.

3. Place the feet on the springs and depress.

Plate 3

Setting the Trap.

Plate 4

The Set Trap is Located Beneath the Matchbox, Which Has Been Introduced Only for the Sake of this Photograph.

4. With hands, push jaws open and place the toe of one boot on the fixed jaw.

5. With one hand, raise the loose jaw and raise the plate sufficiently for the lug to catch over the tongue.

6. Without allowing the plate to fall, remove the feet. The trap is now set. The trap can also be set in a reverse to this method, by commencing with the loose jaw away from the operator.

7. It is a mistake to set traps lightly. Lightly set traps will catch birds, lighter animals, and reptiles. To set at the correct firmness, cut a green stick about 2 in. long, and one-eighth in. thick (depending on the trap) and use this stick to prop up the plate. Make sure the plate rests level after setting.

8. At the predetermined spot for setting, dig out a hole the size of the trap, and place this soil on a piece of canvas. After placing the set trap in the hole, cover it over with *this* soil. By this method, only a small area of soil is disturbed. Do not make any other unnecessary disturbance on this ground.

9. Care must always be taken to make the set look natural. Brush the soil on top of the trap with a piece of bush, so that this area simulates adjacent terrain.

10. Do not waste unnecessary time setting the trap as this leaves extra man smell.

11. In an "off-the-pad" set, possibly selected with the aid of a domesticated dog, or by previous knowledge of dingo habits, a decoy is used. Most suitable decoys are fresh dog manure and/or urine. Doggers have most secret decoys which they will not disclose to anyone, but it is safe to assume that dog manure and urine are the basis of such decoys, and in some cases the urine is collected from a bitch in season.

Plate 5

A Typical Dog Fence.

12. The trap is set about 9 in. out from the selected tree or tussock, and the decoy is placed between the trap and the object.

13. If it is necessary to trap on a pad, set the trap so that the jaws are running with the pad. No decoy is necessary. Success has been achieved in using timber or rocks to guide the unwary dog onto a trap set on a beaten pad, but a cunning dog will shy off if the natural surroundings are disturbed.

14. Caught dogs have proved useful decoys. One trapper hung a dingo carcass 4 ft. above the ground and set underneath. He was rewarded with four catches in less than one year.

15. The drag chain on a new trap is about 20 in. long. Some trappers prefer to lengthen this to about 3 ft., and attach a weight of about 5 lb. to the free end. Their reason for a free drag is that caught dogs will not spoil the set for further trapping by their struggling. Trapped dogs soon get caught up in timber—central western doggy country is well timbered—and usually bite the trap and are soon poisoned. Doggers expect to catch many dogs in good sets with free drags, and some suggest that these spots improve with catching. One dogger has several sets where he has caught over 40 dogs in each, over the last 6 years. Only a bad dog evades such sets.

16. If at all possible, and without creating excessive disturbance to the surrounds, the free drag should be buried.

I am indebted to the experienced graziers and doggers who have freely given very useful information. It is their wish that someone will be able to get useful ideas that will assist in the eradication of a serious menace.

* * *

Calf Birth Weights

Information has been requested on the birth weights of normal calves.

Differences occur both within breeds and according to breed, but the following weight ranges will account for the largest group within each breed:

Jersey	:	50-61 lb.
Guernsey	:	65-71 lb.
Ayrshire	:	71-78 lb.
Friesian	:	93-99 lb.
Hereford	:	68-72 lb.

In the case of the dairy breeds the lower weight is the average for females and the higher weight the average for males.

Twins and triplets are lighter than calves of the same breed born singly.

If cows are on a very low plane of nutrition during the second half of pregnancy, birth weights could be considerably below the figures given.

Plate 1

Massed Bed of Hydrangeas at the Medical School, Herston. Shrubs are not yet in full bloom.

Hydrangeas Are Rewarding

By D. DOWDLES, Adviser in Horticulture.

There are few floral displays to equal that of a massed bank of hydrangeas in full bloom in late spring and early summer. Rich green foliage provides a contrasting background to the spectacular flower clusters which range in colour from pale blue to pink. As a pot plant, too, the hydrangea adds distinction to patios, sheltered verandahs, and bush-houses. These lovely ornamental plants attain their best development in temperate climates. They are, however, popular in southern Queensland and results are rewarding even in the tropics and subtropics.

The ornamental potential of the hydrangea was first realised in the 18th century when Thunberg, the Swedish botanist, first saw this strange and attractive bloom during a visit to Japan. He carried the news and enthusiasm back to Europe—but no specimens; in those days Japan was a "closed" country. Before the end of the century, however, the plant was brought to Kew Gardens in England and established there. Since then, many varieties have been evolved by hybridisation and selection.

35 SPECIES; 1 CLIMBER

There are about 35 cultivated species of hydrangea. Some, like *H. petiolaris,* are climbers which reach a length of 60 ft. or more. The major cultivated groups are dwarfed, however, and include a wide range of medium-sized shrubs which branch stiffly to a height of 4 to 6 ft.

The leaves are normally a bright green, varying from 3 to 8 in. in length and often nearly as wide. The leaf edges are serrated.

The most striking feature of the hydrangea is the flower head. In the cultivated varieties, the small flowers are partially or completely sterile and the petals subordinated to the showy sepals of the calyx. The sepals are large with a spread of one-half to 3 in. and highly coloured.

The individual flowers in the bloom vary in shape according to species and variety; some are round and symmetrical while others are irregular with pointed sepals. In some large-flowered types, the sepals are attractively serrated and sometimes fringed.

VARIETIES FOR QUEENSLAND

The hydrangeas grown in Queensland belong mainly to the species *H. opuloides* and fall into two distinctive groups, known as *japonica* and *hortensia.* In *japonica,* the flower clusters carry both fertile and sterile flowers. The heads are somewhat open and flattish in shape and the sepals are small and cupped. In the *hortensias,* on the other hand, the flowers are sterile and the flower clusters are compact, ranging from round to globe-shape with densely arranged and flattened sepals. The more popular garden varieties belong to the *hortensia* group.

There are numerous varieties; some of the best are:

Dwarf

Ami Pasquer.—Crimson or soft blue; very free flowering.

Etincelant.—A reliable dwarf with compact flower heads; colour tints rather soft.

President Doumer.—A fairly recent dwarf type; flowers well over a long period.

Medium

Elmar.—Serrated sepals; rich blues and reds; large flower heads.

Liebling.—Rounded sepals in "fours"; deep and soft blues to pinks and reds.

Deutschland.—A good red in a suitable medium; large flower heads with densely arranged sepals.

Prince Henry.—Sepals variable and pointed; wide colour range.

Tall

Altona.—Spherical, large heads cherry-pink to mid-blue; late flowers often change to a deep red.

Domotoi.—Sepals pale pink or pale blue; a high-class "double".

Plate 2

Flower Clusters of Japonica Type Hydrangea.

Rubis.—Large rounded heads with wide sepals; reds, pinks, and lavenders persist well in this variety.

When planted with colour contrast in mind, these provide an excellent background to dwarf and medium varieties.

PROPAGATION

Hydrangeas are not difficult to propagate. Mature wood cut from canes in late winter strikes quite readily in a good rooting medium and even immature wood cut in spring will grow if given sufficient care and attention.

Whatever the type of wood used for propagation, the cutting should be severed cleanly from the parent plant with a secateur cut below one node and a second cut above a node nearer the growing point.

All types of cuttings need a good rooting medium such as a 1:1 mixture of coarse sand and well-rotted leaf mould. After planting with about two-thirds of its length below ground, the cutting should be kept under semi-shade, sheltered from wind and well supplied with moisture.

Bush and lath houses are excellent for propagating hydrangeas; each cutting can be set in its own pot and given routine care. Good results can also be obtained in shaded areas of the home garden. In hot weather, a clear plastic cover is helpful; it allows light to penetrate, keeps the air moist round the cutting and excludes drying winds.

ASPECT

The hydrangea is easily damaged by high temperatures, intense sunlight and hot wind. Choice of aspect is therefore important in Queensland; scorching of foliage and flowers can be severe when the shrubs are exposed to hot midday and afternoon temperatures in late spring and summer.

When hydrangeas are planted for a mass display, an east to south-east aspect, which is shaded in the afternoon and protected from hot westerly winds should be selected. The eastern side of a high wall or a trellised evergreen creeper is excellent. Trees and tall shrubs also make an excellent backdrop for hydrangeas.

Potted plants are useful in the garden; the pots can be moved from place to place according to weather and season so that the shrubs get the best possible growing conditions.

SOIL AND WATER

Soil type is not very important for hydrangeas, provided drainage is good. Manure can be incorporated in the bed before planting but, even in manured beds, a 5:13:5 or similar fertilizer should be incorporated in the soil. Normal rates of application are: For beds, a handful to each square yard; for pots, a handful to each 1½ cu. ft. of soil. Once the plants are established, a light application of fertilizer after the winter pruning and again at the first sign of flowering is desirable.

Potted plants may be injured by excessive amounts of fertilizer. It is usual, therefore, to replace the fertilizer by a nutrient solution containing 1 oz. of a soluble fertilizer in 1 gal. of water. After applying the solution, the plant should be thoroughly watered.

Bedded hydrangeas will stand a lot of water particularly when in full leaf and bloom. A light sprinkling each day is so much wasted effort; it is better to give the plants a thorough soaking once or twice a week.

Potted plants tend to dry out quickly in hot weather and, from time to time, the pots should be placed in shallow trays of water. The pots can, of course, be moved to a shady place if stress symptoms become apparent during hot weather.

MANAGEMENT IN POTS AND BEDS

For decorative purposes, hydrangeas can be grown in pots and tubs containing a mixture of sand, loam and well-rotted organic matter in equal quantities. Crock or gravel in the bottom of the container is needed to allow free drainage of excess water.

Repotting each year is desirable. To do this, lift the shrub from its container in early autumn, prune the roots, cut the head back and then replant in fresh soil. If the plants have to be transferred to larger pots, open up and spread the roots when replanting.

When small potted hydrangeas are required in quantity for display purposes, fresh cuttings should be planted each year. Cuttings which are rooted in spring will generally bloom in the following season but only one or two buds should be allowed to form flower heads.

For out-door beds, the soil should be well prepared before the new hydrangea plants are set out. Dig the ground deeply and work any available manure into the soil a month or so before planting. For a massed display, tall varieties provide an excellent background to the medium and dwarf varieties. The former need a 4 to 5 ft. spacing but the low-set mediums and dwarfs may be planted 2 to 3 ft. apart. Even so, spacings vary according to position, soil type and cultural treatments.

PRUNING

The best results are obtained when hydrangeas are properly pruned and trained.

The major pruning is carried out in late winter when the buds begin to swell. Very old wood should be cut out; low-set canes provide good renewal material. Healthy 2-year-old wood is shortened back to one or two strong buds and long canes are cut back to thick wood with good buds. Surplus canes must be eliminated; they merely crowd out the more productive wood. The pruned shrub should have a well-spaced, sturdy framework and a balanced series of branches with evenly spaced buds.

In later summer, a light pruning is often beneficial. Canes carrying spent flower heads are removed to open up the shrub to light and air. When this is done, the young canes develop evenly and may bear late blooms; the wood from these young canes should mature in autumn for the next season's flowering.

For best flowering in the hydrangea, some thinning out of the side shoots is essential. Only the terminal shoots (for flowers) and the basal pair (for renewal canes) need be retained. The others should be rubbed out when they appear.

COLOURING THE BLOOMS

Blues, whites, pinks, or reds? Gardeners are often perplexed when the colour of their blooms changes from a rich red to violet or lavender and then to blue over a couple of seasons.

Colour in the hydrangea is determined by the intake of aluminium through the roots. This varies with the type of soil and is particularly high in many strongly acid soils with a high clay content.

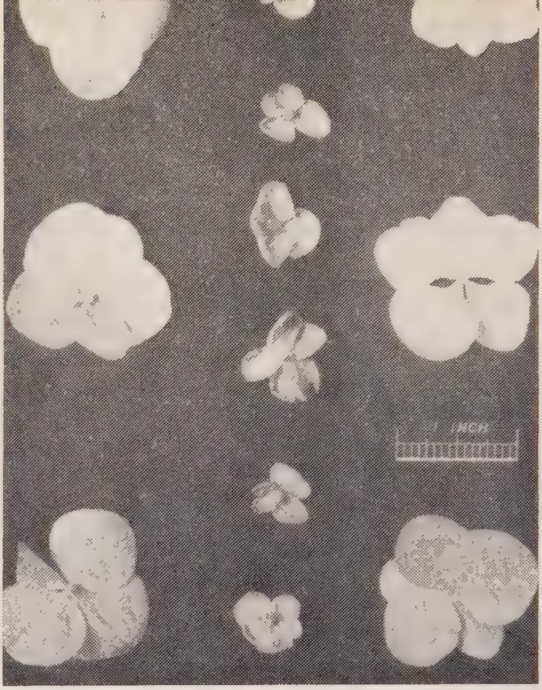

Plate 3

Single Flowers Detached from Flower Clusters of Hydrangea. Centre, typical small sepals of *japonicas*; sides, large sepals of *hortensias*.

High aluminium intake tends to the production of blue flowers and this accounts for the change in colour of what were originally pink- and red-flowering shrubs when the roots penetrate a clay subsoil. On heavy-textured soils, it is difficult and often impossible to produce blooms of any other colour than blue. On loams and sandy loams, however, the flower colour is more easily controlled.

Some well-tried techniques are:

(*a*) To change pinks and reds to blues, water the shrubs periodically with alum (2 oz. in 1 gal. of water). Alternatively, apply alum (4 oz. per sq. yd.) to the soil.

(*b*) To change blues to pinks, apply lime each year at a rate of ½ lb. per sq. yd. of bed. Results may be only fair on clay soils, and over-liming may result in leaf chlorosis and lack of vigour in the plants.

Pink colour is best maintained in hydrangeas by growing the plants in pots containing a slightly acid or slightly alkaline soil, 6 lb. of lime having been incorporated with each cu. yd. of the standard potting soil.

What To Do For Arthritis

Arthritis (rheumatism) includes a group of rheumatic diseases which cause inflammation of the joints. Though alike in affecting the joints, these diseases differ in causes, symptoms and other aspects.

The two most common forms of arthritis are rheumatoid arthritis and osteoarthritis. Other important forms are arthritis due to specific infection, and gouty arthritis.

RHEUMATOID ARTHRITIS

This form is most common among young adults, especially women. It usually begins before 40 years of age.

Generally it is caused by a combination of factors. The first definite symptoms are usually preceded by a long period of ill health. The person is generally below par, tires easily, and is susceptible to colds, and other respiratory infections. Heredity seems to be a predisposing cause.

Other factors contributing to the cause of rheumatoid arthritis may be injury to one or more joints; prolonged exposure to cold and damp; overcrowding and similar unfavourable living conditions. Infection and prolonged emotional stress—grief, fear and worry—are important influences.

Rheumatoid arthritis is a disease of the entire system. It produces inflammation of the joints and often involves various other tissues, for example, those of the muscles. If untreated, the condition leads to wasting away of the cartilage and thinning of the bones at the joints.

Active disease may begin with inflammation of several joints, gradually without fever, or suddenly with fever and rapid heart beat. The smaller joints are affected first, perhaps the joints in the fingers and feet. Later on, the larger joints become involved. Slight joint pain and swellings may come and go for years until finally one joint after another becomes stiff, painful and swollen. In addition to the joint symptoms, there may be anaemia, fever, digestive disturbances, mental depression, nervous irritability, and loss of weight and energy.

Without treatment, rheumatoid arthritis may progress until the larger joints become permanently stiffened, resulting in varying degrees of helplessness.

OSTEOARTHRITIS

This, the most common joint disorder, is a disease of middle or old age, rarely becoming established before 40 years of age.

Osteoarthritis is caused by ageing of the cartilage of the joints, intensified by wear and tear of the joint tissues. The joints most frequently affected are those at the ends of the fingers, and those which bear strain, such as the knees and the spine.

Sometimes injuries are partly responsible for the changes in the joints. The injury may be sudden, such as a fracture, or may result from long-continued strain, produced perhaps by overweight or faulty posture.

There seems to be an hereditary susceptibility, as this disease is more common in some families than in others.

The onset is usually gradual. It is common for finger tips, knees, hips, shoulders and vertebrae to be attacked first. A slight soreness or stiffness, aggravated by exercise, may be the first symptom, and as time goes on, the joints become more and more uncomfortable. The pain is usually moderate, although it may become fairly constant, and may be severe when the joint is used more than usual. It is relieved by rest.

As time goes on, the affected joint becomes thickened, and creaks or grates on movement. If untreated, the disease may grow progressively worse. Small, loose pieces of bone and gristle may collect in the joints and hamper movement.

With early treatment, the wearing away of the joints may be slowed down or completely stopped. The sufferer can be relieved from pain and may regain more or less ability to use his joints, according to his age.

GO TO A DOCTOR

The first and most important thing to do is to have a thorough medical examination at the first signs or even suspicions. If proper treatment starts before the joints have been severely damaged, the outlook for improvement and relief is bright. Less can be done after the joints are deformed.

Is the State of Mind Important? Indeed it is! Emotional stress plays a large part in arthritis, both in the onset and the recurrence. The patient will improve more rapidly if he can avoid worry and despondency and set himself confidently to do the job of getting well. To do this, he must be given an understanding of the disease. He must face the facts, accept the possibility that a long period of treatment may be necessary, do his best to co-operate with the doctor, and persevere in following the plan of living recommended for him.

The person who wins the fight over his thoughts and emotions has the best chance of defeating this disease.

Never put off a visit to the doctor while you try some new diet that someone suggests for "rheumatism." Don't rub an inflamed joint or try to limber it up with exercise. In one type of arthritis, the painful joint is made worse by bending or rubbing it. There is another kind that sometimes improves with these measures. Let your doctor be the judge of your particular case.

Most arthritis patients are not helped by a change of climate, although some feel more comfortable when the weather stays warm. A person with arthritis should not consider a move if the added expense and other difficulties would cause worry.

Rest is essential to the arthritis sufferer's improvement. Even after the initial bed rest, when the patient is up and about, a long night's rest and rest periods during the day are very desirable. At all times, every care should be taken to avoid strain, injury, and excessive use of the joints.

In some cases diet is much more important than in others. Here again it is the doctor who must decide in each individual case. Generally speaking, people with arthritis need a good, balanced diet, with a variety of foods for each meal. Good elimination is important, and the doctor will advise about this.

The use of heat and massage can be very helpful in some cases, but should never be attempted without a doctor's supervision.

The doctor may prescribe various drugs, which should never be taken except under his direction. Beware patent medicines promising quick relief from chronic arthritis. They do not cure the disease, and may even be harmful.

As to new "wonder" cures, whatever sensational reports you may hear, be guided by your doctor. He has access to authoritative information that you never see. He knows that most drugs have their drawbacks as well as their advantages, and he will not prescribe any medicine that has not been thoroughly tested.

PREVENTION

While there is no specific preventative, your living habits can do quite a lot to protect you from arthritis. Do all you can to keep in good health in every way. Have a medical check-up once a year. Watch your weight, and don't let it get far from normal; have a well-balanced diet; get enough sleep and fresh air; protect yourself against cold and dampness, both indoors and out; try to get your share of pleasant recreation.

Do your best to keep worry or grief or nervous tension from getting you down. Tell your troubles to your doctor or some other sympathetic friend. Have the interest of a hobby.

Guarding your general health is especially important if there is a tendency towards arthritis in your family.—*Queensland Health Education Council.*

FLOWER BALLS

Have you ever seen "flower mobiles" as part of the decorations at a party? They look so lovely and are easy to arrange. These flower balls are suspended over the table on fine threads from the ceiling light.

The string by which they are suspended is tied round a piece of sponge rubber, which is moistened to keep the flowers fresh. This is then covered with foil in the shape of a ball. The foil is pierced with a darning needle, and short-stemmed flowers inserted. A small, low arrangement on the table below the mobiles gives balance and looks delightful. They also make the most of a limited number of flowers.

Simple Accounting For The Farmer

By E. O. BURNS, Senior Agricultural Economist.

This is the first article in a series on the financial management of farms. It has been written in response to many requests from farmers for a simple but sound accounting system, and it is intended for the typical small or moderately sized family farm. The case of the larger property will be dealt with later, as will be the additional subjects of cost accounting and farm budgeting.

Most farmers who keep any financial books confine themselves to listing cash receipts and payments. These, by themselves, are of very limited usefulness, and it is not surprising that many farmers after doing this for a year or two decide that "keeping books is a waste of time."

The purpose of keeping books is to have available the necessary information for drawing up an operating statement and balance sheet at the end of the financial period. These Final Accounts, as they are called, show the profit made during the year's operations, and changes in the value of the farm assets and liabilities. The Final Accounts also permit various types of analysis and comparison which are essential for sound farm management.

Contrary to what most farmers believe, a taxation return is not a very good substitute for an accounting statement drawn up from a properly kept set of books. The real financial position is obscured by concessions designed to encourage investment in primary production by reducing the burden of taxation payable by the farmer.

The regulation requiring assets to be depreciated completely over 5 years results in a considerable understatement of the capital value of assets employed in the business. Similarly, the value of livestock is normally much greater than is shown in the taxation return. Also distorting the true position is the privilege, which farmers alone have, of claiming certain items of capital investment as current operating expenses.

A properly kept set of financial books will make it easier for your accountant to prepare your taxation return (and presumably reduce the fee for this service). This, however, is only an incidental advantage of record keeping. It is necessary to get completely away from the idea of the taxation return as a major financial document.

The aim in this article has been to design a system which is both simple and sound. It is obvious that with this aim in view, a certain amount of compromise must be expected between utmost simplicity and absolute accuracy.

The simplest form of bookkeeping consists of entering in a book particulars of cash receipts and payments. This, as mentioned earlier, is insufficient and barely justifies the time taken, if no further use is made of the figures. The most accurate system, on the other hand, makes use of the "double entry" principle but very few farmers would be prepared to acquire the technical skill and training ncessary to operate it.

There are many grades of refinement possible between these two extremes. It is very hard to be dogmatic about just how much detail should be worked into a ready-made system. Not only do farms vary considerably in their structure, but farmers' requirements and aptitudes also show considerable variation.

For this reason, a basic system has been designed, which represents the minimum amount of work consistent with an acceptable standard of accuracy.

By following the simple steps of the basic system you will be able to prepare an annual operating statement and balance sheet which will not in normal circumstances be significantly inferior to that prepared from a double entry set of accounts.

A properly kept set of financial records can be as profitable a tool as any piece of plant on the farm. They will show you what your returns were from your different products, how much you paid for different cost items, what your overall financial position is, what your capital is earning for you, what the farm is paying for your own labour. **But more important than this is the opportunity of control over your business which only books can give you.**

This is achieved mainly by comparison with previous periods or with standards, or with averages; by comparing not only totals but various efficiency ratios such as income per acre, per cow and per labour unit, income per £ of costs, costs per acre or per head of livestock, and capital turnover rate. Control is achieved by noting variations in these ratios, ascertaining the causes, and modifying your farm plans accordingly.

BASIC SYSTEM

Financial Year

Once the decision has been made to keep books, the next thing is to fix the starting date. The best date generally is July 1. That gives you a financial year which ends on June 30, the same as the taxation year. The calendar year ending December 31 is quite good, as also is the statistical year ending March 31.

What Books to Keep

To make record-keeping worth while, there are four types of books you must keep. They are—

1. Inventory (List) of Assets and Liabilities
2. Record of Receipts and Payments
3. Paddock and Production Records
4. Daily Diary

Inventory of Assets

It is important that you make a list of these items as at the day you start to keep accounts. You will have to place a value on all items. These values will be the starting point for the system and should be conservative estimates of what you, yourself, would be prepared to pay for the buildings and machinery in their present condition.

There are three separate Inventory Account to be kept, but they can all be kept in one book. Once you start the system, you will not have to touch this book very often, and it will last fo many years.

A dissection Cash Book is the best book to get for your Inventory Accounts. Make certain it is one that opens out across the double page. You may have to rule some lines yourself. A book with, say, 36 to 50 pages will be ample and allow plenty of room for expansion. All of these Inventory Accounts are to be ruled across a double page.

When ruling up the accounts illustrated in Tables 1 to 5, it is not necessary to include the reference column on the left hand side of these tables. These reference columns are merely to make the worked example easier to follow.

Buildings and Equipment

The first of these accounts is the Inventory of Buildings and Equipment. This is illustrated in Table 1.

Note that the date and value are to be shown for any additions and disposals. This is so that adjustments can be made in the depreciation. For example, if you have the use of an item for 6 months you will allow half the annual depreciation.

The actual rate of depreciation can vary considerably depending on use and maintenance, but the following rates will probably be fairly accurate on most farms.

Motor vehicles	15 per cent
Machinery and equipment ..	10 per cent.
Buildings and fences ..	3 per cent.

Do not use the 20 per cent. rate which is allowed for taxation.

Depreciation is calculated at the end of each year so that the value of the asset is shown in the inventory at the closing date at a proportionately reduced value.

Livestock

A complete inventory of all livestock is to be taken when you first start to keep these books, and thereafter only at the end of each 12 months. This is illustrated in Table 2.

Once you have adopted a value per head for working and breeding animals (for example dairy cows), this should not be altered unless there are very special reasons for increasing or decreasing your valuation. A temporary fluctuation in saleyard prices would not be a sufficient reason. With herd bulls, however, it is quite in order to reduce the value of an ageing bull, and to increase the value of a young animal as he reaches maturity.

Animals that are being raised for resale are in a different category. Each time the inventory is taken, these should be valued at estimated market value.

Feed, Seed and Farm Supplies

An inventory of miscellaneous items, such as hay, seed, bags, cases, fertilizer, petrol, kerosene, &c., should be made out when you start the system, and thereafter at the end of each 12 months. The way in which this is drawn up is shown in Table 3.

The value per unit to use for feed and seed that you have grown yourself should be conservative and as near as you can get to direct costs of production. Absolute accuracy is not required. Value only those crops which are actually in the barn. Take no notice of growing crops.

The unit value of bought feed, and of miscellaneous items such as bags, cases, fuel and lubricants, should be as near as possible to landed cost at the farm.

Record of Receipts and Payments

The idea of keeping inventory accounts may have been new to many of you, but you will be on more familiar ground with receipts and payments. Farmers who keep even the most elementary financial records generally have some record of receipts and payments.

You will need separate records. There are too many lines to rule, and you should be able to buy at any stationer's, a suitable cash book with dissection columns. These books have a date column, a space for particulars, and then a series of money columns extending right across the double page.

Cash Receipts

The Cash Receipts Book should be patterned on Table 4.

The first money column should be headed "Total". The last column on the right hand side should be headed "Non-farm Income," and the second last one should be headed "Capital Sales". The headings you put on the columns in between depend on what type of farm you have. A dairy farm would have "Cream," "Pigs," "Calves," and so on. Other types of farm might have "Beans," "Tomatoes," "Maize" or "Lucerne Hay." Items comprising Livestock and Produce Sales should be grouped under their respective headings, as shown in Table 4.

The principle is that every time you receive money, the amount should be entered twice—once always in the total column, and once in the appropriate dissection column. The "Capital Sales" column is to record the sale of any piece of capital equipment, such as farm machinery or land. This transaction will also be recorded in the appropriate inventory. If you enter all your capital sales and purchases in your receipts and payments books when they occur, you can copy these into your inventories at the end of the year.

Cash Payments

Cash Payments are dealt with in the same manner as Farm Receipts. Table 5 shows how the book should be set out. The extreme right hand column in this case is "Capital Purchases," and the second last column is "Other Expenses."

There is only one exception to this. Do you want to keep a record of your household expenditure as well as the farm expenditure? This is optional, and whether you do or not does not affect the Final Accounts and analysis at the end of the year as it affects the farm. Some people find it convenient to incorporate their household expenses in the one set of farm books, this arrangement being a handy reference and control over household spending. If you are one of these, the best place to put your "Household" column is on the extreme right, outside "Capital Purchases". This has been done in the example shown in Table 5.

Accounting for household expenditure does, however, introduce some complications, and is not recommended for farmers who want to increase their management efficiency with a minimum of book work. Those who are still interested will find further details in Appendix C.

The headings you use in the other dissection columns depend on your type of business. Here are some suggestions—Wages, Contracts, Fodder, Fertilizer and Seeds, Fuel and Oil, Repairs and Replacements, Rates and Taxes, Cartage and Freight. Think of the expenses that occur fairly regularly. Odd items can go into "Other Expenses".

Costs of clearing, and any other capital expenditure which permanently increases the improved value of the land, should be entered in the "Capital Expenses" column.

Worked Example

The operations of the basic system are illustrated in the following example. Cash payments and receipts during the year are shown, together with lists of buildings and equipment, livestock, and feed, seed and supplies on hand at the beginning and end of the year.

The list of assets and transactions is much smaller than would occur in actual practice, and is purely for illustration. For purposes of simplicity, shillings and pence have been eliminated. In actual practice, the exact amount would, of course, be shown.

To make the example easier to follow, each item has been given a reference number. This number will be found against the equivalent entry in the left hand column of Tables 1–5.

Assets at July 1, 1961, were valued as follows :

		£
1.	Barn	300
2.	Fencing	600
3.	Tractor	800
4.	Utility	500
5.	Plough	45
	Livestock	
6.	30 cows at £25	750
7.	10 heifers at £15	150
8.	1 bull at £60	60
9.	20 pigs at £10	200
	Feed, Seed and Supplies	
10.	10 tons lucerne hay at £5	50
11.	6 bags meatmeal at £2 10s.	15
12.	40 gal. power kerosene at 2s. 6d.	5

Receipts and Payments during the year were as follows :

13.	July 15	Received cream cheque	50
14.	July 25	Tractor repairs	21
15.	Aug. 3	Sold 8 pigs	95
16.	Aug. 20	Bought 2 tons lucerne hay	30
17.	Sept. 5	Paid vet fees	5
18.	Sept. 25	Sold pumpkins	6
19.	Oct. 11	Paid rates	2
20.	Oct. 22	Bought petrol	2
21.	Nov. 15	Received cream cheque	100
22.	Nov. 18	Sold 10 pigs	110
23.	Dec. 15	Received cream cheque	175
24.	Dec. 23	Bought store pigs	35
25.	Jan. 6	Sold calves	6
26.	Jan. 13	Received cream cheque	210
27.	Feb. 14	Bought bran and pollard	40
28.	Feb. 21	Sold pumpkins	7
29.	Feb. 22	Received cream cheque	240
30.	Mar. 13	Sold plough	30
31.	Mar. 15	Received cream cheque	18
32.	Mar. 21	Sold 4 cows	115
33.	Apr. 13	Received cream cheque	180
34.	Apr. 14	Bought power kerosene	16
35.	Apr. 21	Repairs to barn	30
36.	Apr. 30	Bought harrows	60
37.	May 15	Paid telephone account	25
38.	May 26	Bought fertilizer	26
39.	June 6	Bought bull	42
40.	June 25	Sold 8 pigs	96

On hand at 30th June, 1962 :

	Livestock	
41.	26 cows at £25	650
42.	15 heifers at £15	225
43.	1 bull at £60	60
44.	1 bull at £40	40
	Feed, Seed and Supplies	
45.	48 gal. power kerosene at 2s. 6d.	6
46.	Fertilizer ½ ton No. 1	13
47.	Ensilage	20

Opening inventories of Buildings and Equip-nent, Livestock, Feed, Seed and Farm Supplies ave been entered up, together with the year's ash receipts and payments, and closing inventories of Livestock and Feed, Seed and Farm upplies.

Before the annual statements can be prepared, losing entries must be made in the inventory f Buildings and Equipment. This involves ntering up additions and disposals during the ear and calculating depreciation.

The steps are as follows:

1. Make an entry of all buildings and pieces f equipment bought during the year in the nventory of Buildings and Equipment. The particulars should be taken from the "Capital Purchases" column of the Payments book. Tick ach item in the "Capital Purchases" column when you transfer it to the Inventory.

2. Make an entry against the item in the nventory when the building or equipment is sold r scrapped. These particulars are taken from he "Capital Sales" column of the Receipts book. Tick these items in a similar manner to those n the "Capital Purchases" column of the Payments book.

3. Calculate depreciation on the opening alues at the rate shown in the second column. Enter this in the "Depreciation" column and leduct from the opening value to give the closing alue.

Two points should be noted in the example iven:

(*a*) The plough which was sold for £30 had value at the beginning of the period of £45. The difference of £15 should be entered as lepreciation and entered in the "Depreciation" olumn. The "Value" column at the closing eriod will naturally show zero.

(*b*) The harrows bought for £60 at the end f April were in the business for 2 months. The lepreciation over this period will naturally be ne-sixth of annual depreciation.

ANNUAL STATEMENTS

Merely entering up the year's transactions in he Inventories and the Receipts and Payments Books tells very little about your operations during the year. All this information must be summarised so that it can tell its story in simple and concise manner.

This can be done by the use of three summary statements:

1. Livestock Statement.
2. Operating Statement.
3. Net Worth Statement.

The Livestock Statement shows the gross income from the purchase and sale of livestock. The Operating Statement shows the Farm Income (or net profit) from the farm operations during the year. The Net Worth Statement shows changes in the capital value of the farm.

Having calculated the depreciation in the Inventory of Buildings and Equipment, and totalled the value columns in the Inventories and the Cash Receipts and Payments books, we are now in a position to draw up these statements.

Livestock Statement

Except on purely agricultural farms, livestock represents a considerable amount of money. A large proportion of the livestock, also, is destined for resale and conversion into cash. For this reason, changes in the value of livestock on hand at the beginning and end of the accounting period have a direct effect on the true profit or loss made during the year.

The Livestock Statement is a summary of livestock transactions during the year and is used to calculate the gross income from buying, selling and rearing the livestock on the farm. Remember it deals with the animals only; income from wool or cream, for example, is shown separately.

Gross income from livestock is calculated by adding inventory values at the commencing date and cost of livestock purchased, and subtracting this figure from the sum of inventory values at closing date and the value of livestock sold during the period.

This is illustrated in Table 6.

These are the steps to be taken:

1. The totals of the livestock sales columns of the Cash Receipts Book (Table 4) are transferred to Gross Sales in the Livestock Statement (Table 6).

2. The totals of the livestock purchases columns of the Cash Payments Book (Table 5) are transferred to Livestock Purchased in the Livestock Statement (Table 6).

3. Closing and Opening Inventories in the Livestock Statement are transferred in total from the Inventory of Livestock (Table 2). The break-up into cattle, pigs, &c., is not shown separately in the inventory, but has to be calculated before entering the figures in the Livestock Statement. The closing inventory for one period is the opening inventory for the next period.

4. Where the sum of gross sales and closing inventory is greater than the sum of livestock purchased and opening inventory, there is a "Gain from Livestock". Where the reverse applies, there is a "Loss from Livestock".

It is suggested that the Livestock Statement be ruled to show several years on the one page for purposes of comparison. This, however, is not essential, and a separate statement can be made out each year if preferred.

Operating Statement

It is by the use of the Operating Statement that you calculate your Farm Income for the year.

Farm Income is the figure left after deducting cash expenses and depreciation from gross farm income. It is the return the farm makes for the use during the year of capital, farmer's own and unpaid family labour and management. Interest on borrowed capital has to come out of farm income, and it also has to be shared with the Taxation Commissioner.

The Operating Statement calculated from the worked example is set out in Table 7. This has been shown in a tabular form suitable for recording a number of years, for comparison.

Gains and losses on livestock are transferred from the Livestock Statement (Table 6).

Other items appearing under "Gross Income" are determined by the headings used in the Cash Receipts book (Table 4) under "Livestock Sales" and "Produce". To these are added "Increase in Inventory of Feed, Seed and Supplies", if there was an increase in the value of these items.

Other items appearing under "Farm Expenses" are determined by the headings used in the Cash Payments book (Table 5) under "Farm Expenses", to which are added "Decrease in Inventory of Feed, Seed and Supplies", if applicable, and "Depreciation".

Depreciation is taken from the Inventory of Buildings and Equipment (Table 1), and the increase or decrease in Inventory of Feed, Seed and Supplies is the difference between the totals at the beginning and end of the period for this Inventory (Table 3).

Net Worth Statement

The Net Worth Statement, also called a balance sheet, is a listing of all farm assets and debts. If this is made out annually, it shows whether you are making any progress, or whether you are dropping behind financially.

It is a simple statement to prepare if you have kept accounts as described in this article The most useful way to set it out is in columnar form, as recommended for the Livestock and Operating Statements, as this permits easy comparison from year to year, as well as reducing the clerical time necessary to set up the headings

Table 8 shows the Statement prepared from the worked example.

The first portion of the Statement calculates the value of farm investment. The figures for Buildings and Equipment, Livestock and Feed Seed and Supplies are taken direct from the appropriate inventories. To keep the work as light as possible no inventory was prescribed for Land in the Basic System. The optional use of an Inventory of Land is described in Appendix B.

The value to be placed against land should be your estimate of bare, improved value, excluding buildings, fences, &c. It is assumed that the farm in the example has 220 acres valued at £20 per acre, a total value of £4,400. The value of land should not be changed from year to year except in exceptional circumstances, and then only when the changed valuation can be expected to be of relatively long duration. Of course, if some land is sold or extra land bought, the valuation should be changed.

Similarly, the valuation should be increased i costs of clearing, or any other capital expenditur

TABLE 1

INVENTORY OF BUILDINGS AND EQUIPMENT

Ref.	Item	Depreciation Rate	Value 1-7-61	Additions		Disposals		As at 30-6-62	
				Date	Value	Date	Amount	Depr.	Value
			£ s. d.		£ s. d.		£ s. d.		£ s. d.
1	Barn	3%	300 0 0					9	291 0 0
2	Fencing	3%	600 0 0					18	582 0 0
3	Tractor	10%	800 0 0					80	720 0 0
4	Utility	15%	500 0 0					75	425 0 0
5	Plough	10%	45 0 0			13-3-62	(*b*) 30 0 0	15	..
			2,245 0 0						
	Harrows	10%		3-4-62	(*a*) 60 0 0			1	59 0 0
								198	2,077 0 0

(*a*) Transferred from "Capital Purchases" in Cash Payments Book—Form 5.

(*b*) Transferred from "Capital Sales" in Cash Receipts Book—Form 4.

TABLE 2

INVENTORY OF LIVESTOCK

Ref.	Class of Livestock	As at 1-7-61			As at 1-7-62			As at 1-7-63			As at 1-7-64		
		No.	Value per Head	Total Value	No.	Value per Head	Total Value	No.	Value per Head	Total Value	No.	Value per Head	Total Value
			£ s. d.	£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
6	Cows	30	25 0 0	750 0 0	*41* 26	25 0 0	650 0 0						
7	Heifers	10	15 0 0	150 0 0	*42* 15	15 0 0	225 0 0						
8	Bull	1	60 0 0	60 0 0	*43* 1	60 0 0	60 0 0						
9	Pigs	20	10 0 0	200 0 0									
		..	..	1,160 0 0									
44	Bull				1	40 0 0	40 0 0						
					..	..	975 0 0						

TABLE 3

INVENTORY OF FEED, SEED AND FARM SUPPLIES

Ref.	Item	Unit	As at 1–7–61			As at 1–7–62			As at 1–7–63			As at 1–7–64		
			No.	Value per Unit	Total Value	No.	Value per Unit	Total Value	No.	Value per Unit	Total Value	No.	Value per Unit	Total Value
				£ s. d.	£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
10	Lucerne Hay	tons	10	5 0 0	50 0 0									
11	Meatmeal	bags	6	2 10 0	15 0 0									
12	Power Kero.	gal.	40	0 2 6	5 0 0	*45* 48	0 2 6	6 0 0						
			..	..	70 0 0									
46	Fertilizer (No. 1) ..	tons				½	26 0 0	13 0 0						
47	Ensilage	tons				10	2 0 0	20 0 0						
						..	..	39 0 0						

TABLE 4

CASH RECEIPTS

Ref.	Date	Particulars	Total	Livestock Sales		Produce				Capital Sales	Non-farm Income
				Cattle	Pigs	Cream	Pumpkins		Other		
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
13	July 15	Cream	50 0 0			50 0 0					
15	Aug. 3	8 Pigs	95 0 0		95 0 0						
18	Sept. 25	Pumpkins	63 0 0				63 0 0				
21	Nov. 15	Cream	100 0 0			100 0 0					
22	Nov. 18	10 Pigs	110 0 0		110 0 0						
23	Dec. 15	Cream	175 0 0			175 0 0					
25	Jan. 6	Calves	60 0 0	60 0 0							
26	Jan. 13	Cream	210 0 0			210 0 0					
28	Feb. 21	Pumpkins	75 0 0				75 0 0				
29	Feb. 22	Cream	240 0 0			240 0 0					
30	Mar. 13	Sold plough ..	30 0 0							(*a*) 30 0 0	
31	Mar. 15	Cream	220 0 0			220 0 0					
32	Mar. 21	Sold 4 cows ..	115 0 0	115 0 0							
33	Apr. 13	Cream	180 0 0			180 0 0					
40	June 25	8 pigs	96 0 0		96 0 0						
			1,819 0 0	175 0 0	301 0 0	1,175 0 0	138 0 0			30 0 0	

(*a*) Transferred to Inventory of Buildings and Equipment—Table 1.

TABLE 5

Cash Payments

Ref.	Date	Particulars	Total	Livestock Purchases		Farm Expenses				Capital Purchases	Household Expenses
				Cattle	Pigs	Fodder	Fuel	Repairs	Other		
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
14	July 25	Tractor repairs ..	21 0 0					21 0 0			
16	Aug. 20	L/hay (2 tons) ..	30 0 0			30 0 0					
17	Sept. 5	Vet. fees	5 0 0						5 0 0		
19	Oct. 11	Rates	25 0 0						25 0 0		
20	Oct. 22	Petrol	22 0 0				22 0 0				
24	Dec. 23	Store pigs	35 0 0		35 0 0						
27	Feb. 14	Bran and pollard ..	40 0 0			40 0 0					
34	Apr. 14	Power kerosene ..	16 0 0				16 0 0				
35	Apr. 21	Repairs barn ..	30 0 0					30 0 0			
36	Apr. 30	Bought harrows ..	60 0 0							(*a*) 60 0 0	
37	May 15	Telephone a/c ..	25 0 0						25 0 0		
38	May 16	Fertilizer	26 0 0						26 0 0		
39	June 6	Bought bull ..	42 0 0	42 0 0							
			377 0 0	42 0 0	35 0 0	70 0 0	38 0 0	51 0 0	81 0 0	60 0 0	

(*a*) Transferred to Inventory of Buildings and Equipment—Table 1.

TABLE 6

Livestock Statement

—	1961–62			1962–63			1963–64			1964–65		
	Cattle	Pigs	Total	Cattle	Pigs	Total	Cattle	Pigs	Total	Cattle	Pigs	Total
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Gross sales	175 0 0	301 0 0	476 0 0									
Closing inventory	975 0 0	..	975 0 0									
	1,150 0 0	301 0 0	1,451 0 0									
Livestock purchased ..	42 0 0	35 0 0	77 0 0									
Opening inventory	960 0 0	200 0 0	1,160 0 0	975 0 0	..	975 0 0						
	1,002 0 0	235 0 0	1,237 0 0									
Gain from livestock ..	148 0 0	66 0 0	214 0 0									
Loss from livestock ..	..	..	..									

TABLE 7

OPERATING STATEMENT

—	1961–62	1962–63	1963–64	1964–65
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Gross Income—				
Gain on livestock—				
Cattle	148 0 0			
Pigs	66 0 0			
Cream	1,175 0 0			
Pumpkins	138 0 0			
Increase in inventory of feed, seed and supplies	..			
	1,527 0 0			
Farm Expenses—				
Loss on livestock—				
Cattle	..			
Pigs	..			
Fodder	70 0 0			
Fuel	38 0 0			
Repairs	51 0 0			
Other	81 0 0			
Decrease in inventory of feed, seed and supplies	31 0 0			
Depreciation	198 0 0			
	469 0 0			
Farm Income	1,058 0 0			

TABLE 8

NET WORTH STATEMENT

—	1–7–61	30–6–62	30–6–63	30–6–64
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Land	4,400 0 0	4,400 0 0		
Buildings and equipment	2,245 0 0	2,077 0 0		
Livestock	1,160 0 0	975 0 0		
Feed, seed and supplies	70 0 0	39 0 0		
Value of farm investment	7,875 0 0	7,491 0 0		
Add—				
Value of dwelling				
Cash at bank				
Other investments				
Sundry debtors				
Deduct—				
Bank overdraft				
Sundry creditors				
Farmer's net worth				

which permanently increases the improved value of the land, have been incurred during the year. These costs will have been entered originally in the "Capital Purchases" column of the Cash Payments book.

The Value of Farm Investment is an important figure for farm management analysis. It represents the amount of capital which could be withdrawn (by selling the farm) and invested in some other business. The rate of interest which the farm is earning can be calculated on this figure, and compared with what the capital could earn in other businesses.

To find out your own financial position, it is necessary to add to the value of farm investment the value of your dwelling, cash in bank, other investments, and amounts owing to you by sundry debtors; and to subtract from this total your bank overdraft, if any, and any other amounts which you owe to sundry creditors. Suitable headings have been shown in the pro forma Net Worth Statement, but no figures have been given.

BASIC ANALYSIS

The farm income as shown in the Operating Statement (Table 7) is the net amount earned by your capital and labour during the year. You will probably want to know how this compares with what you could have earned had your capital and labour been employed otherwise during the year.

To calculate what your labour earned, we deduct from farm income the estimated amount which your capital could have earned elsewhere.

Similarly, we deduct from farm income what your labour could have earned elsewhere, in order to find what your capital returned.

The procedure is as follows:

1. Find the average value of farm investment for the year. This is done by averaging the opening and closing values shown in the Net Worth Statement. (Table 8).

2. Calculate interest on this amount at the rate you consider you could have invested at comparable risk.

3. Deduct interest calculated in this manner from farm income, and the result is the return to your own labour.

4. Decide what you think would be a fair wage for your labour, and deduct this from farm income. The result is the return to capital. Calculate what percentage this is of the average value of farm investment during the year, and that is the rate of return earned by the capital.

5. The Return to Management is an overall measure of general efficiency. This is the sum which the farm returned over and above the interest and wages which could have been earned in some other employment.

Workings, using 6 per cent. as the rate of interest on capital and £15 per week (£780 per annum) as a fair reward for labour, are shown hereunder.

TO CALCULATE RETURNS TO LABOUR, CAPITAL AND MANAGEMENT

Value of Farm Investment (from Table 8)—

	£
Opening (1–7–61)	7,875
Closing (30–6–62)	7,491
	£15,366
Average	£7,683

	£
Farm Income (from Table 7)	1,058
Interest on Capital (6% of £7,683)	463
Return to Labour	£595

(Or about £11 9s. per week)

	£
Farm Income (from Table 7)	1,058
Own Labour (£15 per week)	780
Return to Capital	£278

Rate of Return earned by capital—

$$= \left(\frac{278}{7{,}683} \times 100\right) \text{ per cent.}$$

$$= 3{\cdot}6 \text{ per cent.}$$

Return to Management—
= £1,058 − (463 + 780)
= £1,058 − 1,243
= −£185

(−£185 means that this farm earned £185 less than the farmer could have got with his capital invested otherwise and working for wages of £15 per week.)

Other Useful Measures

In order to increase farm income, one needs either to increase output or decrease costs, or both.

Accounts can give you a useful guide as to whether you should be concentrating on increasing production or reducing costs.

Two useful measures are the Capital Turnover Rate and the Receipts/Expenses ratio. These are calculated as follows, from the Operating and Net Worth Statements:

Capital Turnover Rate—

$$=\left(\frac{\text{Gross Income}}{\text{Value of Farm Investment}} \times 100\right) \text{ per cent.}$$

$$=\left(\frac{1{,}527}{7{,}683} \times 100\right) \text{ per cent.}$$

$$= 19{\cdot}8 \text{ per cent.}$$

Receipts per £ Expenses—

$$= £\left(\frac{\text{Gross Income}}{\text{Farm Expenses}}\right)$$

$$= £\left(\frac{1{,}527}{469}\right)$$

$$= £3{\cdot}26$$

The general rule in interpreting these measures is that if the Capital Turnover Rate is low, attention should be given to increasing production; if the Receipts per £ Expenses is low, attention should be given to reducing costs.

No exact standards can be laid down for either of these measures at the present time, but a rough observation based on limited research suggests that a farm with a capital turnover rate of 25 per cent., and receipts of £2 per £1 expenses should be in a healthy economic position. Anything less than 20 per cent. and £1·5 respectively should give cause for concern.

In the example given, the Receipts/Expenses ratio is particularly good. Nothing could be gained on this farm by reducing costs.

The capital turnover rate on the other hand is somewhat low. This suggests that attention should be directed towards expanding output. Even if this results in a considerable increase in costs, it could still be profitable, because the cost structure at the present time is extraordinarily low, as demonstrated by the very high Receipts/Expenses ratio.

A further indication that output is on the low side is given by another useful measure—Gross Income per Labour Unit (we will assume that this is a one-man farm, with no hired or family labour).

Gross Income per Labour Unit is calculated by dividing gross income by the number of full-time male workers, or their equivalent.

In this case, gross income per labour unit i £1,527. This measure will vary considerabl depending on the farm-type, but most farm would probably require a gross income of £2,50 per labour unit to enable them to be ru profitably.

A gross income per labour unit of £1,52 suggests that the labour is not being used to it maximum capacity. Possibly it would be mor productive if it were allied to a greater capita investment and if cash expenses were increase by increasing some inputs.

To illustrate the manner which this financia analysis can be used in improving farm management, suppose on this farm, a way could be seen whereby gross income could be increased b £1,000. Suppose that this did not require an extra labour, but would need an additiona capital investment of £1,500 in machinery an would increase cash expenses by £500 per year Annual expenses would thereby be increased b £650, representing £500 cash expenses and £15 depreciation.

Comparing this situation with that in the example, we get the following comparative position:

	Example	Suppositio
Farm investment	£7,683	£9,108
Gross income	1,527	2,527
Farm expenses	469	1,119
Farm income	£1,058	£1,408
Return to labour	595	860
Return to capital	3·6%	6·9%
Return to management	−£185	£80
Capital turnover	19·8%	27·7%
Receipts per £ expenses	£3·26	£2·26
Gross income per labour unit	£1,527	£2,527

The various efficiency measures for the supposition case are now highly satisfactory an there are no obvious weaknesses in the financia structure.

SUPPLEMENTARY RECORDS

If your financial records are to play their ful part as a farm management tool, they must be supplemented by additional records which will be determined by the general farm pattern. This section deals with the minimum records necessary, but these can be extended and varied to fi your particular farm once you have grasped th basic principles.

Records help you to increase your efficiency and hence your farm income by drawing attentio to the strong and weak points in your farm organisation. Comparison is more important in economic analysis than the actual financial statement by itself. Comparison may be made with other farms if information is available, or with some standard of performance, but most usually, comparison with previous years on the same farm is the most readily available.

To do this we need to calculate certain ratios such as gross output per acre and per labour unit, yields per acre and per livestock unit, and so on. We therefore require certain information in addition to that covered in the account books.

Cropping Records

At the very least you will need to know the area planted to each crop and the production. It would pay you to go to a little extra trouble, though. It is suggested that you get an ordinary exercise book, give each paddock a number or name, and allocate a certain number of pages to each paddock.

Make a note of all operations, such as cultivating, fertilizing, planting, grazing and irrigating. This will save relying on your memory for rotations, soil amendments, and so on.

Leave a page or two at the beginning of the book for a cropping summary. These pages could be ruled up as follows:—

Crop Summary

Crop	Paddock	Area	Dates		Period Grazed	Production	Disposal		
			Planted	Harvested			Sale	Feed	Seed
Maize	3, 6	20	19–11–59	30–3–60	..	200 bags	..	200	..
Oats	2	10	15–3–60	..	April–May	..	..	..	..
Potatoes ..	7	3	1–8–60	15–11–60	..	18 tons	18	..	..

Dairy Records

We will not be dealing with breeding, calving or Herd Recording Records. These are very valuable records and can hardly fail to have an indirect effect on farm profits, but they have little direct relationship with financial analysis.

It is amazing, however, how many dairy farmers have no permanent record of their production or the number of cows milked or the number of calves and pigs they have sold.

The following rulings will provide the minimum information necessary, but they can be made more detailed if desired. For example, you could add a column for down-graded cream, if you wished:

Dairy Production Record

Month	1959–60			1960–61			1961–62		
	Average No. Milkers	Cream Production	Average per Milker	Average No. Milkers	Cream Production	Average per Milker	Average No. Milkers	Cream Production	Average per Milker
July									
August ..									
September ..									
Etc. ..									

Livestock Sales

Month	1959–60						1960–61						1961–62					
	Pigs		Calves		Cows		Pigs		Calves		Cows		Pigs		Calves		Cows	
	No.	£	No.	£	No.	£	No.	£	No.	£	No.	£	No.	£	No.	£	No.	£
July																		
August																		
September																		
Etc.																		

These examples are intended only as illustrations. A different layout may be preferable for your own particular farm. It is not essential, for instance, to have more than one year's figures on the one page. It is a handy reference, but if you want more detail, there will be insufficient space on the one page.

From these and similar records, it is possible to calculate a number of efficiency measures. Comparing these with previous years can often help you in making your farm plans by drawing your attention to strong or weak points that may be developing in your business.

These statistics should be kept in a way that permits easy reference. A few measures which you may find useful have been shown for illustration only. These will not apply to every farm, of course, and you will probably be able to think of others which would be useful in your own business.

Annual Statistics

——	1960–61	1961–62	1962–63	1963–64	1964–65
Gross Income per Acre					
Cash Costs per Acre					
Average Production per Cow					
Yield per Acre—Maize					
Yield per Acre—Potatoes					
Average Return per Bushel—Maize					
Average Return per Ton—Potatoes					
Average Return per Acre—Maize					
Average Return per Acre—Potatoes					
Acres per Cow—Pasture					
Acres per Cow—Crops					
Average Selling Price—Pigs					
Average Selling Price—Calves					
Receipts per £ Expenses					
Capital Turnover Rate					

Daily Diary

The Daily Diary is a day-by-day record of the activities of the farm, and although mentioned last is probably the most important part of the record system. It may be of any size and no special ruling is required.

You should make a note in the diary of everything that affects the farm business—work done, cows milked, stock deaths, sales and purchases, rainfall and so on.

You will find that the Daily Diary will provide most of the information you need to write up your records. Tick off the items in your diary as you enter them up.

CONCLUSON

The mere fact of keeping books does not, of course, turn an unthrifty farm into a profitable business. Properly used, however, they are invaluable in pointing to structural weaknesses and in giving you a starting point from which to consider your management problems.

A comparison year by year of the various ratios and efficiency measures will enable you to recognise trends and to make whatever adjustments are called for.

Without records, a farmer, no matter how efficient he may be at husbandry, is being controlled by forces over which he has little influence, and of which he may in fact be quite ignorant.

Records properly kept and intelligently used are powerful weapons which make it possible for the farmer to exert a measure of control over these forces in his economic environment.

APPENDIX A

In the basic system, the Operating Statement has been drawn up from the Cash Receipts and Payments Books. The Operating Statement also takes into account gains and losses on livestock and changes in value of held feed, seed and supplies, but does not consider amounts owing by or to the farmer, at balancing date. For example:

(*a*) A crop may have been sold prior to closing date, but the proceeds have not yet been received. Gross income as shown in the Operating Statement will therefore be lower than it should be. Persons or firms owing money may be called *Sundry Debtors.*

(*b*) Some item of cost may have been incurred prior to closing date, but payment has not yet been made. Farm expenses have been understated by this amount. Persons or firms to whom money is owing may be called *Sundry Creditors.*

Sundry debtors and creditors were excluded from the basic system on the grounds of simplicity. Also most farmers are used to considering their income and costs on a cash basis because that is the normal taxation practice. It is probable that in most circumstances an adjustment for outstanding debits and credits would not alter the position materially. The carry-over from year to year would probably be much the same.

Examples might include a cream cheque due for June delivery or a produce merchant's or repair shop's account.

In some circumstances, however, outstanding debtors and creditors might affect the financial position significantly. In these cases, and also of course where the farmer is prepared to do the little bit of extra work necessary for greater accuracy, it is desirable to modify the Operating Statement accordingly.

The procedure is as follows:

(*a*) At the commencement of the system, make a list of all sundry debtors and sundry creditors.

(*b*) At the end of the financial year, make a similar list.

(*c*) An increase in Sundry Debtors during the year should be shown under Gross Income.

(*d*) A decrease in Sundry Debtors during the year should be subtracted from Gross Income.

(*e*) An increase in Sundry Creditors during the year should be shown under Farm Expenses.

(*f*) A decrease in Sundry Creditors during the year should be subtracted from Farm Expenses.

The headings of the Operating Statement will then be as follows:

Gross Income.
  Gain on Livestock—
    Cattle . . . . . .
    Pigs . . . . . .
  Cream . . . . . .
  Pumpkins . . . . . .
  Increase in Inventory of Feed,
    Seed and Supplies . .
  Increase in Sundry Debtors . . ————
  Less Decrease in Sundry
    Debtors . . . . . . ————
                        ————

Farm Expenses.
  Loss on Livestock—
    Cattle . . . . . .
    Pigs . . . . . .
  Fodder . . . . . .
  Fuel . . . .
  Repairs . . . . . .
  Other . . . . . .
  Decrease in Inventory of Feed,
    Seed and Supplies . .
  Depreciation . . . .
  Increase in Sundry Creditors ————
  Less Decrease in Sundry
    Creditors . . . . ————
                        ————
  Farm Income . . . . ————

It will, of course, be necessary to retain a record of Sundry Debtors and Creditors, so as to compare the items at balancing date with the outstanding amounts at the end of the previous period. This can be done conveniently by ruling two pages as follows:—

Inventory of Sundry Debtors

Money owed by	For	1–7–60	30–6–61	30–6–62	30–6–63

Inventory of Sundry Creditors

Money owing to	For	1–7–60	30–6–61	30–6–62	30–6–63

Note that if you include Sundry Debtors and Creditors in your operating statement in this way, the Farm Income shown should be accurate, but the individual items shown (cream, fodder, repairs, &c.) are still on the cash basis. There is no indication as to which items are affected by the changes in debtors and creditors.

Greater accuracy may be obtained by showing the changes in debtors and creditors associated with each item of income and costs separately—for example:

Cream	1,175	
Increase in amount outstanding	75	
		1,250

This, however, complicates the record keeping, and is not recommended for farmers starting on

TABLE 9

INVENTORY OF LAND

Description	Tenure	As at 1–7–61			Changes in Land holding	As at 30–6–62			As at 30–6–63			As at 30–6–64			As at 30–6–65		
		Area	Value U/Imp.	Value Imp.		Area	Value U/Imp.	Value Imp.	Area	Value U/Imp.	Value Imp.	Area	Value U/Imp.	Value Imp.	Area	Value U/Imp.	Value Imp.
		Acres	£	£		Acres	£	£	Acres	£	£	Acres	£	£	Acres	£	£
Pors. 3, 4, 5 and 6, Parish of Wombat . .	Freehold	220	660	4,400	Sold por. 6 (20 acres) 30–3–63	220	660	4,400	200	600	4,000	200	600	4,000	200	600	4,000
Pors. 70 and 71, Parish of Wallaby	Freehold	. .	. .	. .	Purchased 1–1–63 . .	. .	. .	. .	. .	. .	. .	100	350	1,500	100	350	1,500
												300	950	5,500	300	950	5,500

this basic system, unless they have had previous accountancy training.

APPENDIX B

On the big majority of farms, land holding remains static for long periods of time, often remaining unchanged through generations of farmers. In these circumstances, there is little point in ruling up an inventory for land, and none has been prescribed in the basic system.

For those farmers, however, who do occasionally buy, sell or rent land, or who think there is a possibility of doing so at some future date, it is desirable to have a permanent record of the effective land used from time to time in their businesses.

If you are in these circumstances, an Inventory of Land, as illustrated in Table 9, will prove a useful record, and will provide immediately the necessary land valuation required for the Net Worth Statement (Table 8).

You will have a record of the Unimproved Value. The improved value you will have to estimate yourself. A good plan is to base your estimated value on prices which have been paid for similar type land in your district. Remember, this should be improved, bare value and should not include buildings, machinery or stock.

Any change made in land holding should be noted briefly and the adjusted area and value should be entered at the end of the financial year.

Costs of clearing, and any other capital expenditure which permanently increases the improved value of the land, should also be transferred to this inventory from the "Capital Purchases" column of the Cash Payments book.

APPENDIX C

It is a common practice on smaller farms for the farmer to have one bank account covering both his business and private transactions.

In these circumstances, the farmer never really knows how his private (or household) expenditure stands in relation to his income.

In the main text of this article it was stated that a column for "Household Expenditure" could be included in the Cash Payments Book, but that this was optional and was not, in fact, generally recommended, because of the complications it introduced into the basic system.

Actually, these complications are more apparent than real, and farmers who have been operating the basic system for a year or two, or those who have had some previous experience in bookkeeping should find no difficulty in accounting for household expenditure.

It is unnecessary to enter up each individual item of expenditure separately. Most farmers would be quite satisfied merely to calculate the total amount spent annually on household expenses, although durable goods, such as refrigerators and radiograms could conveniently be shown individually.

Generally speaking, as a cheque is drawn for private purposes, all that is necessary is to show the amount in the "Household" column.

There are two points to be noted here. Often the one cheque will cover farm expenditure as well as household expenditure. In these cases, it is necessary, of course, to allocate the amounts into the proper columns of the Cash Payments Book.

The other point concerns all those small private and household payments that are made by cash. It is almost essential to get into the habit of drawing cheques from time to time solely for household money. The value of the cheque will go straight into the Cash Payments Book. It is not necessary to wait until it is spent.

It is just as important that any cash received should be banked as soon as possible. You can get your books into a terrible tangle if, for example, you go to town to spend the cash you got for the sale of a calf.

If you include household expenditure in your Cash Payments Book, and Non-Farm Income in your Cash Receipts Book your books will then show all your receipts and payments, both business and private.

This will make it possible for you to reconcile your account books with your bank statement, which will act as a check on the accuracy of your records.

Co-operation Brought Makarikari Grass To Gympie District

Plate 1: **Makarikari Trial Plots at Scrubby Creek.**

By N. W. DOHERTY, Adviser in Agriculture.

The successful introduction of Makarikari grass to the Gympie district represents yet another example of the benefits that can be gained from co-operation between the farmer or grazier and the Department of Agriculture and Stock.

Gympie District farmer, Mr. L. Starkey, of Scrubby Creek, was particularly impressed by Department's reports on the performances of the grass in other districts and decided to carry out a test under his own local conditions.

He sought assistance from the Department in obtaining planting material, and it was decided that portion of the expense of the project should be borne by the Dairy Pasture Improvement Standing Fund. This fund was established by the Australian Dairy Produce Board to finance a portion of experimental work being done by the Department on dairy pastures.

Accordingly, arrangements were made for the supply of planting material from "Brian Pastures", Gayndah; for fertilizer to aid establishment of the newly sown grass; and for assistance and advice by the local Adviser in Agriculture.

Mr. Starkey accepted the proposals an established a quarter acre introductory plot.

Some surplus planting material was used t establish small plots elsewhere and these, togethe with the original introductory plot, have suppli planting material for further plots.

The grass is performing quite satisfactoril under local conditions and a further expansion i both number and size of plots is expected in th coming season.

As usual, time and detailed observations ar required to establish the value of Makarikari gras to the district.

It is felt, though, that the co-operation betwee the Department and the farmer will materiall hasten progress in this particular case. A routin enquiry has been converted, by co-operation, t a project that has introduced, multiplied, distri buted and partially tested Makarikari grass in th Gympie district.

Commercial planting material is not yet available, and seed production problems are bein studied at "Brian Pastures".

Plate 1: **This Poll Hereford Bull, "Sandalwood Flick 2nd" Weighed 2,311 lb. at 33 Months of Age.** Fast growth rate is a strongly inherited characteristic in beef animals.

Which System Of Cattle Production?

By K. F. HOWARD, Formerly Senior Adviser In Cattle Husbandry.

In any particular area the beef producer has some choice of the type of production in which he will engage. This article compares the likely returns from various possible methods in good brigalow country in the Miles district.

For purposes of comparison, a standard ype of property has been taken as a model. The roperty is assumed to contain 3,000 acres, on hich the timber has been treated. Costs which ould be regarded as more or less common to ny of the methods of production have not been onsidered. These include normal operating osts and the basic improvements of fencing, rovision of water facilities and timber treatment.

Costs which are taken into account are those ncurred in establishing improved pasture or in rowing a crop for grazing.

In order to avoid involved calculations no allowance has been made for stock deaths. The cost of depasturing bulls has also been excluded. Where breeding has been involved, a calving rate of 80 per cent. has been assumed.

Prices of stock are based on those ruling in 1958 and are net on the property. The costs of selling stores in local saleyards or fats at Cannon Hill have been deducted. Fat cattle prices are calculated on a carcass beef price of £6 per 100 lb. at Cannon Hill.

The price of £21 10s. for cows applies to either fat cows or cows with calves at foot.

Cattle prices have risen considerably since these figures were obtained. The previous relationship between carcass price and store cattle price has been upset somewhat by the exceptionally strong demand for lean beef during 1959 and 1960.

Six possible systems are now compared:

1. Breeding and Selling Weaners or Yearlings:

The breeding herd will comprise 270 cows at the stocking rate of 1 cow to 8 acres. The yearly calf crop comprises 216 head which are allowed 4 acres per head. Progeny are sold at the age of 12 to 15 months when steers have an average liveweight of 550 lb. Heifers should weigh 500 lb. and are sold at 12 to 15 months of age.

Sales are as follows:

	£
108 steers at £17 10s. .. .. .. =	1,890
54 heifers at £15 12s. .. .. .. =	842
54 cull cows at £21 10s. .. .. .. =	1,161
Total	3,893

Return per acre = £1 3s.

2. Breeding and Selling 2-Year-Old Stores:

The herd comprises 219 cows and 174 calves stocked at the same rate as in System 1. In addition there are 87 yearling steers which are allowed 6 acres per head.

Sales are:

	£
87 two-year old steers at £26 2s. .. .. =	2,270
43 heifers (similar to system 1) at £15 12s. =	671
44 cull cows (as for system 1) at £21 10s. =	946
Total	3,887

Return per acre = £1 3s.

3. Breeding and Fattening on Native Pasture:

The herd consists of 180 cows, 144 calves and 72 yearling steers at the same stocking rate as in systems 1 and 2, together with 72 2 to 3½ year old steers with an allowance of 8 acres per head.

Steers are sold at 3 to 3½ years of age at a liveweight of 1,170 lb. and a carcass weight of 620 lb.

Sales are:

	£
72 head fat steers at £33 15s. .. .. =	2,430
36 heifers as in systems 1 and 2 at £15 12s. =	561
36 cull cows as in systems 1 and 2 at £21 10s. =	774
Total	3,765

Return per acre = £1 2s. 6d.

4. Breeding and Fattening on Crop and Improved Pasture:

In this case it is assumed that the 3,000 acre holding incorporates 378 acres of crop consisting of 315 acres of oats and 63 acres of sweet

Plate 2

Two-year-old Store Steers in September, 1957. They were forward stores in the previous April but lost weight during winter.

Plate 3

The Same Steers as Shown in Plate 2, at a Liveweight of 1,218 lb. at Just Over 3 Years. Average dressed weight was 633 lb. The average lifetime gain was 1 lb. a day but there were periods in each year when they were not gaining but actually losing weight.

Plate 4

Fat Steers from the Wandoan Area in 1957. Average liveweight was 1,156 lb. for a daily lifetime average gain of 1.5 lb. a day. They were weaned on to a grain sorghum crop in the winter of 1956, and then kept gaining in weight until marketed. Grazing included Rhodes grass, lucerne, sweet sudan and sweet sorghum.

sorghum, together with 252 acres of lucerne in pastures. At a cost of £3 10s. an acre, 378 acres of crop costs £1,323.

Two-year-old steers dressing 620 lb. (53 per cent.) are sold from July to December for an average price of £6 10s. per 100 lb. dressed weight. Heifers are sold as fats at 12 months of age dressing 330 lb. and also bringing £6 10s. per 100 lb.

If the lucerne stand lasts 4 to 5 years, and allowing for an annual renovation, the cost of the lucerne area will be approximately £1 10s. an acre yearly. The total annual lucerne cost is thus £378 and the total cost of crop and lucerne is £1,701 annually.

The herd comprises 315 cows with an allowance of 6 acres each of native pasture, plus a month or so of crop or improved pasture at calving time in August-September. There are 252 calves which are weaned on to crop and pasture on the basis of 1 calf to half an acre of oats and half an acre of lucerne plus 1 acre of native pasture. Yearling steers comprise 126 head which are allowed half an acre of sweet sorghum, 1 acre of lucerne, 1½ acres of oats and 2 acres of native pasture.

Sales are:

		£
126 steers at £36 14s.	=	4,614
63 fat heifers at £19 4s.	=	1,210
63 fat cows at £26 (dressed weight 530 lb.)	=	1,638
Gross Sales Return	=	7,462
Less costs of crop and improved grazing ..	=	1,701
Sales return less costs of crop and improved grazing	=	5,761

Return per acre = £1 18s. 5d.

If the equivalent of 3s. an acre of this return were spent annually on fodder conservation, a substantial reserve could be built up in a few years. This would appear to be an essential qualification under this system. On the other hand, a good season could mean that additional stores could be purchased for topping off on surplus winter and spring feed.

5. Buying and Fattening on Native Pasture:

It is expected that 428 steers could be fattened. This is a stocking rate of 1 steer to 7 acres which takes into account the fact that the steers are expected to be turned off within 10 months.

Store steers are bought at 2½ years of age for £26. The average estimated liveweight at this stage is 830 lb. After a 10 months' fattening period, all are turned off at an average liveweight of 1,170 lb. (620 lb. estimated carcass weight) for a return on the property of £33 18s. per head.

The difference between sale price and purchase price is thus £7 18s. per head, giving a total return of £3,381, or £1 1s. 6d. an acre.

6. Buying and Fattening on Crop:

Under this system it is assumed that 2 steers per year are fattened on 3¼ acres of native pasture, half an acre of sweet sorghum and 1¼ acres of oats. The stocking rate and procedure is described on the basis of this 5 acre unit.

One animal is bought in October. It is a yearling, weighing 650 lb. liveweight and costing £20. On native pasture he makes an average gain of 1·37 lb. a day until mid-April when liveweight has increased to 900 lb. (This animal could be sold at this stage for £27 gross but we assume that he is fattened on the property). From mid-April, sweet sorghum provides grazing until oat grazing becomes available in early June. By mid-July the animal is turned off as a fat, having made an average daily gain on crop of 2 lb liveweight a day. Dressed weight is estimated at 572 lb. and the selling price at Cannon Hill in July could be expected to be £6 5s. per 100 lb. dressed weight for a property return of £32 8s. per head. The difference between sale price and purchase price for this steer is £12 8s.

The second animal is placed on crop in July following the sale of the first animal. The purchase price of the second animal is £27 at a liveweight of 900 lb. He is turned off in mid-October at a bodyweight of 1,080 lb. (dressed weight 572 lb.) at a price of £6 15s. per 100 lb. dressed. After deducting selling and transport costs of £3 9s. this gives a property return of £35 3s. The difference between sale and purchase price is £8 3s. The return from the two steers is £20 11s. From this is deducted the cost of 1¾ acres of crop at £3 10s. an acre which is £6 2s. 6d. The annual return from the 5 acres is thus £14 8s. 6d. after the cost of the crop has been deducted. The per acre return is £2 17s. 8d. or a total of £8,650 for 3,000 acres.

It will be realised that this system involves a arge proportion of cultivation—namely 1,050 cres. This calls for greater capital outlay.

The following is a summary of returns per cre which can be expected from the foregoing entures. Normal development and management osts have not been allowed whilst at the same me it is assumed that capital is available for evelopment.

		Return per Acre
ystem 1	: Breeding and selling weaners or young yearlings	£1 3s. 0d.
ystem 2	: Breeding and selling two-year-old stores	£1 3s. 0d.
ystem 3	: Breeding and fattening on natural pasture	£1 2s. 6d.
ystem 4	: Breeding and fattening on crop and improved pasture	£1 18s. 5p.
ystem 5	: Buying and fattening on natural pasture	£1 1s. 6d.
ystem 6	: Buying and fattening on crop	£2 17s. 8d.

These comparisons should never be regarded s hard and fast. Every factor is open to ariation so that returns could be much more or ess. Under equal conditions, the comparison oes give some idea of the relative returns to be xpected.

In some years, the demand for stores by interstate buyers makes buying at the right price almost impossible. On the other hand, prices for fats in the spring over the last few years often have appreciated by £2 and £3 per 100 lb. when compared with prices the previous autum. Profits from oats in 1958 were between £20 and £25 per acre on many properties. In that season, stores were bought on a reasonable market. Two or three mobs were topped off on a paddock and sold from £7 10s. to £9 per 100 lb. at Cannon Hill. Where native grass has been mentioned, it should be remembered that Rhodes grass would mean considerably greater numbers could be carried.

Breeding and fattening on the one property probably affords the safest venture with beef cattle. The breeder and fattener is dependent on suitable prices for the selling market whereas the fattener needs to strike the buying and selling markets when they are both favourable to him. If he has surplus feed the breeder and fattener may also buy steers to fatten if prices are right. The profit in crop fattening is often greatly increased by buying a mob about August, topping them off and selling on a very good fat market in late spring.

BOOK ON POULTRY

Poultry Management and Production, by Allan A. McArdle, Angus and Robertson, 105s.

This book contains a wealth of information n poultry farming in Australia and as such is he first major authoritative work by an Ausralian for Australians. The sections dealing vith the promotion of efficiency practices are xcellent and original for this is the first of all tandard works on poultry husbandry which, to ur knowledge, has endeavoured to show how ayout of equipment has a bearing on labour equirement.

Mr. McArdle has endeavoured to present nformation on a national rather than a State asis and hence the wide application of his book. Nevertheless, treatment of certain subjects such as housing and feeding has more than a dash of local (South Australian) colour. It would be wise for the Queensland reader to heed the advice on these subjects contained in poultry pamphlets from this Department, written exclusively for sunny Queensland conditions.

Whilst husbandry associated with egg production is given the full treatment, table poultry production with its snares and pitfalls is not dealt with in so detailed a manner, notwithstanding the fact that millions of pounds have now been invested in the table poultry industry.

Tuberculosis-Free Cattle Herds

(As at 19th June, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A. & N. K., "Vuegon" A.I.S. Stud, Hivesville, Murge
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boona

Ayrshire

Dudgeon, C. E. R., Marionville Ayrshire Stud, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Offic
Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., "Freshfields", Marburg
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah
Superintendent, Marsden Home for Boys, Station Rd., Nth. Boov

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., The Craigan Farm, Aspley
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, I. S., "Brooklands" Jersey Stud, Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Angel, W. D., "Summerhill", Murgon
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

A List Of Promising Macadamias

Contributed by the Horticulture Branch. *

A limited supply of scion wood is available from selections of Macadamia trees which have undergone promising trials in Queensland.

The genus *Macadamia* is native to the coastal in forests of south-eastern coastal Queensland d northern New South Wales where it is represented by three species—*M. integrifolia*, *. tetraphylla* and *M. ternifolia.* Of these, *. integrifolia* and *M. tetraphylla* bear edible nuts hich have been grown on a semi-commercial ale for a long time.

The tree grows to 40 ft. and has a dense canopy leaves. The leaves are arranged typically in horls of three or four, and the margins may be ooth as in *M. integrifolia* or spined as in *. tetraphylla.* Flowering takes place in spring, e small, white to cream flowers being carried in ndulous racemes. The rounded nut, which is closed in a leathery husk, matures and falls om the tree between March and May in the following year. The shell of the nut may be smooth in *M. integrifolia* or rough as in *M. tetraphylla,* d varies greatly in thickness from tree to tree.

he Present Industry

The Macadamia nut industry is represented in ueensland by some 150 acres of seedling trees in mi-commercial orchards which receive little tention. The tree is also commonly grown in me gardens. Individual trees show considerle variability in growth, nut quality and yield.

Detailed horticultural investigations on the acadamia nut began in Hawaii early in the 20th ntury with material introduced from Queens- d in 1892. Since then satisfactory methods of opagation have been developed in that country and a number of selected scion types are now grown on a commercial scale. Kernels processed in Hawaii sell freely on American markets.

Stock and Scion Selections

Seedling trees are inherently variable and of little value for commercial orchards. Before any major development in the Macadamia nut industry can take place in Queensland, trees propagated from selected stock and scion material must be produced in quantity.

Selection of this material was therefore an essential starting point for horticultural investigations in the crop.

In 1948, seedling orchards in various parts of southern Queensland were surveyed and a number of trees nominated as potential sources of scion and stock material for propagation. The stock trees were chosen primarily for vigour, and seven (R1, R2, R3, R4, R5, R6 and R7) have been retained for testing.

Factors used in assessing the merits of individual trees as sources of scion wood were vigour, growth characteristics, cropping habit, potential yield and nut quality.

In 1950, land was reserved at the Maroochy Experiment Station for stock-scion trials with the Macadamia nut. Propagation of the trees for these trials was, however, carried out at the Redlands Experiment Station, where better facilities exist for nursery work.

Propagation proved to be anything but simple. The best results were obtained from side grafting techniques but, even so, the percentage of "takes" on the several stocks ranged from only 30 per cent. to 50 per cent. This off-turn of grafted trees is lower than that reported from Hawaii and may reflect differences in climate between the two countries.

Grafted trees of the more promising scion selections were subsequently established at the Maroochy Experiment Station.

In view of the current interest in the Macadamia nut as an orchard crop and the demand from nurseries for accredited scion wood, the selections established at the Maroochy Experiment Station, and some other attractive types in commercial orchards, have been named for reference purposes.

Thin Shelled Nuts

The thin-shelled nuts suitable for table purposes in the shell are as follows:—

Amamoor.—Recorded as D8. A *tetraphylla* tree with a rather spindly frame which should however, respond to training. Nuts fairly large but somewhat irregular in shape; kernel recovery 41 per cent. A selection from an orchard at Gildora, via Gympie, which was owned in 1948 by N. R. Greber.

Plate 1

Macadamia Nut Orchard with Trees Approximately 20 years of age. Orchards in Queensland contain seedling trees which vary considerably in yield and nut quality.

Ardrey.—Recorded as J4. A *tetraphylla* tree with an open, spreading growth habit; crop borne towards the centre and includes a proportion of twin nuts. Nuts fairly large; kernel recovery 39 per cent. A selection from an orchard at Flaxton which was owned in 1948 by E. E. Ardrey.

Colliston.—Recorded as Hl. A *tetraphylla* tree of medium size with a tendency to spurring inside the branches; crop matures early with nuts in large clusters. Nuts variable in size and rather susceptible to splitting in the husk; kernel recovery 37 per cent. A selection from an orchard owned by W. Hill, Gilston.

Elimbah.—Recorded as Fl. A *tetraphylla* tre with a dense crown. Nuts medium in size with a mottled shell; kernel recovery, 40 per cent. A selection from an orchard owned by R. Markwell Caboolture.

Flaxton.—Recorded as J3. A *tetraphylla* tre with an open habit of growth bearing much o its crop inside the canopy and maturing the nu early. Nuts small; kernel recovery 38 per cen A selection from an orchard at Flaxton whic was owned in 1948 by E. E. Ardrey.

Greber.—Recorded as D1. A *tetraphylla* tre with an open spreading habit of growth an numerous long branches. Nuts of medium size with a kernel recovery of 43 per cent. Selection from an orchard at Gildora, via Gympie, which in 1948 was owned by N. R. Greber.

Maroochy.—Recorded as J6. A *tetraphylla* tree with a symmetrical shape and spurring well back along the branches. Nuts small; kernel recovery 40 per cent. A selection from an orchard at Flaxton which was owned in 1948 by E. E. Ardrey.

Stephenson.—Recorded as H3. A *tetraphylla* tree with an upright growth habit and weakly spurred; produces a heavy crop which matures early. Nuts medium to large in size but liable to germinate in the husk; kernel recovery 30 per cent. A selection from an orchard owned by W. Hill, Gilston.

Teddington.—Recorded as B21. An *integrifolia* x *tetraphylla* hybrid with a relatively small but vigorous frame carrying abundant spurs. Nuts small; kernel recovery 30 per cent. Selection from an orchard at Tinana, Maryborough, which was owned in 1948 by Rickard Bros.

TABLE 1

THIN SHELLED NUTS SUITABLE FOR TABLE PURPOSES IN THE SHELL

Variety	Shape	Shell Thickness	Kernel Colour	Kernel Recovery
Amamoor	Irregular	Thin to medium	..	41%
Ardrey	Round	Thin	..	39%
Colliston	Irregular	Thin to medium	Fairly even white	37%
Elimbah	Round	Thin	..	40%
Flaxton	Round	Thin	..	38%
Greber	Round	Thin	Even white	43%
Maroochy	Round	Thin	..	40%
Stephenson	Round	Thin	Fairly even white	30%
Teddington	Round	Thin	..	30%

Thick Shelled Nuts

Medium to thick shelled nuts suitable for processing are as follows:—

Collard.—Recorded as L4. A *tetraphylla* tree with a round, reasonably open head; crop well distributed. Nuts large with medium-thick shells; kernel recovery 37 per cent. Selection from an orchard owned by Alcorn Estate, Maleny.

Hinde.—Recorded as H2. An *integrifolia* tree with an open habit of growth and well distributed fruiting wood. Nuts of medium size and borne in clusters of 7 to 8; kernel recovery 32 per cent. Selection from an orchard owned by W. Hill, Gilston.

Howard.—Recorded as L1. A *tetraphylla* tree with an open, spreading frame; crop well distributed. Nuts large with mottled shell of medium thickness; kernel recovery 36 per cent. Selection from an orchard owned by Alcorn Estate, Maleny.

Oakhurst.—Recorded as B20. An *integrifolia* x *tetraphylla* hybrid with well-rounded canopy and a uniformly distributed crop. Nuts large with thick shell; kernel recovery 24 per cent. Selection from an orchard at Tinana, Maryborough, which was owned in 1948 by Rickard Bros.

Rickard.—Recorded as B5. A vigorous *integrifolia* tree with rounded canopy and numerous laterals. Nuts of medium size and thickness, and slightly mottled; kernel recovery 37 per cent. A selection from an orchard at Tinana, Maryborough, which was owned in 1948 by Rickard Bros.

Sewell.—Recorded as N3. A *tetraphylla* tree with a spreading canopy and good cropping potential. Nuts of medium size with kernels evenly coloured; kernel recovery 42 per cent. A selection from an orchard owned by D. A. Sewell, Mt. Tamborine.

Tinana.—Recorded as B6. An *integrifolia* tree with a rounded canopy; crop well distributed through the tree. Nuts of medium size, kernel recovery, 40 per cent. A selection from an orchard at Tinana, Maryborough, which was owned in 1948 by Rickard Bros.

TABLE 2

MEDIUM TO THICK-SHELLED NUTS SUITABLE FOR PROCESSING

Variety	Shape	Shell Thickness	Kernel Colour	Kernel Recovery
Collard	Round	Medium	Variable	37%
Hinde	Round	Medium	Even white	32%
Howard	Round	Medium	Variable	36%
Oakhurst	Round	Thick	Even white	24%
Rickard	Round	Medium	Even white	37%
Sewell	Round	Medium	Even white	42%
Tinana	Round	Medium	Even white	40%

Planting Policy

Commercial production of any fruit is invariably based on a limited number of varieties which have, over a number of years, demonstrated their suitability for a particular region. With a

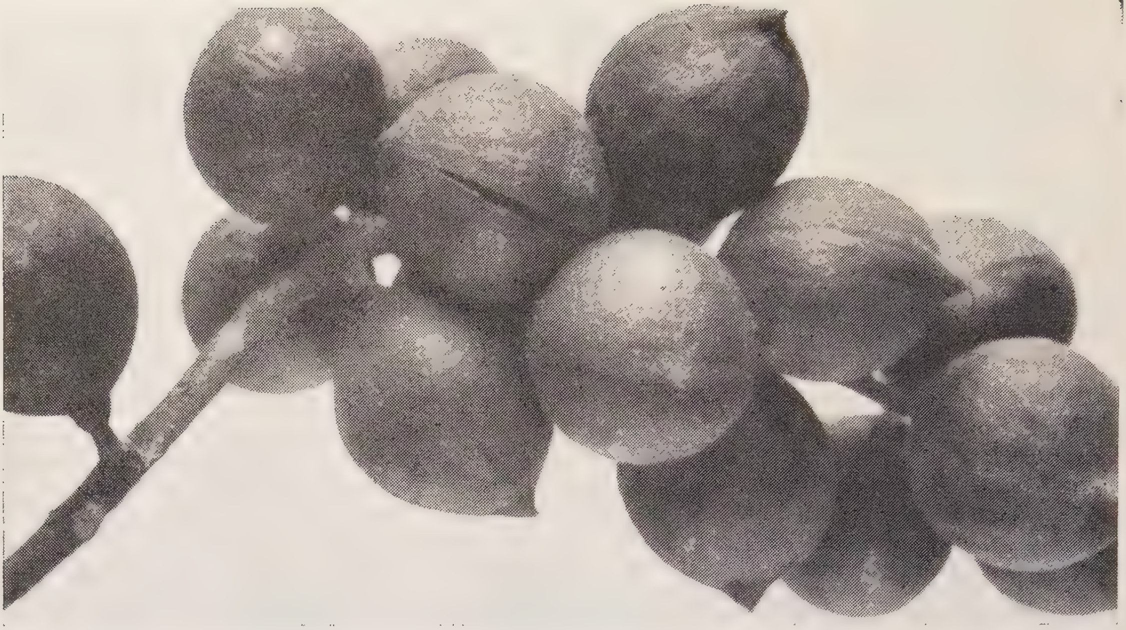

Plate 2

Spray of Macadamia Nuts. The nuts are enclosed in a leathery outer-coat; this splits at maturity, and the nuts fall to the ground.

new crop such as the Macadamia nut, there are limited data to guide nurserymen in their selection of tree types to propagate. Years must necessarily elapse before sufficient information is acquired to justify a firm preference for one selection as against another.

The industry's main concern at the moment is that nurseries should produce grafted trees of the selections listed. Growers can then establish 2 to 3 ac. blocks of trees, each derived from a single line of graftwood. These should mature a uniform type of nut for which there is a market outlet: thin-shelled nuts for the nut-in-shell trade, and medium to thick-shelled nuts for the pr cessing trade. The performance of trees in the blocks over a period of 10 to 15 years will the furnish information on vigour, yield, suscepti bility to pests and diseases, and other agronomi characters which are relevant to productio policy.

In the meantime, advisory staff of the Hort culture Branch can supply scion wood from thes and similar selections in limited quantities o alternatively, indicate sources from which it ca be obtained.

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* Several officers of the Department of Agriculture and Stock have been associated with this project, including Mr. A. A. Ross, now Assistant Director of Marketing, Mr. J. McG. Wills, Senior Adviser in Horticulture, Mr. G. W. J. Agnew, Senior Experimentalist, and Mr. R. E. Leverington, Food Technologist.

The Next Time You See Redwater

By E. R. JOHNSON, Veterinary Officer.

The term "redwater" in cattle is a confusing one. Redwater is a symptom, not a disease. Frequently tick-fever is referred to as redwater, whilst the phrase "calf redwater" usually refers to the bacterial disease of leptospirosis which is often fatal to calves.

Following are some possible common causes of the condition, and they should be kept in mind next time you see redwater:

1. Tick Fever

This is a protozoan disease of older cattle (over 12 months) and is not often seen in calves. Its acute onset and severity are well known. Most affected cattle pass red urine (by excretion of the broken down red blood cells) hence the popular term "redwater". Redwater usually appears about 24 hours after the illness is noticed, or early on the second day. However in severe attacks death may occur before redwater is evident.

If adult cattle show this symptom together with a high temperature, immediate treatment for tick fever is warranted.

2. Leptospirosis

This bacterial disease, commonly called "calf redwater", is somewhat an opposite to tick fever. For example, it is more severe and

Plate 1

Vaccination of a Calf Against Leptospirosis. The vaccine is being injected under the loose skin just behind the shoulder. This is an effective protection against calf redwater.

often fatal *in calves* whilst *adult cattle* suffer a milder illness.

Calves of any age may be affected and symptoms of leptospirosis here are not unlike those of tick fever in the adult. High fever, laboured respirations, anaemia with possible jaundice and redwater are common symptoms. The redwater may vary to an almost black colour. This disease is highly infections in a calf group. Adult cattle usually suffer only a mild temperature, swelling of the udder and depressed milk yield. Abortion is common in in-calf cows.

Deaths are common in calves; in adults, rare. Treatment for this disease should be sought with utmost urgency. Antibiotics are effective if used early in the disease. A preventive vaccine is available for use in calves.

3. Phenothiazine Drenching

Frequently calves will pass red or pink urine following phenothiazine drenching. This occurs on the day after drenching and may persist for 2 or 3 days.

The condition is due to a normal breakdown product of phenothiazine which produces a red dye.

Lactating cows, if drenched, may have their milk discoloured pink also. This milk is not acceptable for human consumption but it may be fed to animals as it cannot harm them.

Calves passing red urine following phenothiazine drenching will be seen to be bright, alert, eating and otherwise normal.

4. Cottonseed Meal Poisoning

Though not extensively fed, cottonseed meal is becoming much more popular in Queensland. Recently a number of calf deaths was encountered from feeding on this meal. The production of redwater was a marked symptom.

It should be remembered that adult cows are not affected by the quantities likely to be fed to balance the protein part of the ration.

Calf poisonings follow a strange pattern. Feeding on the meal is usually quite uneventful until 3 or 4 weeks have elapsed. Then some time after this period, up to possibly 3 months, calves are suddenly found dead or they begin to pass red urine with death following in a day or two. If death is actually seen it will b observed to be similar to suffocation. This i because the natural poison traces in cottonseed meal (gossypol) act by destroying red blood cells. Hence the suffocation; hence the red water.

In a recent outbreak where seven out of 1 calves died, the owner, a sound feeder of al his stock, allowed calves up to 2¼ lb. of cotton-seed meal a day. The calves were aged 3 to months, and, as might be imagined, they were in very good condition.

If cottonseed meal is withheld when redwate is observed those calves showing the discolouration may be saved and those not yet showing it probably will be saved.

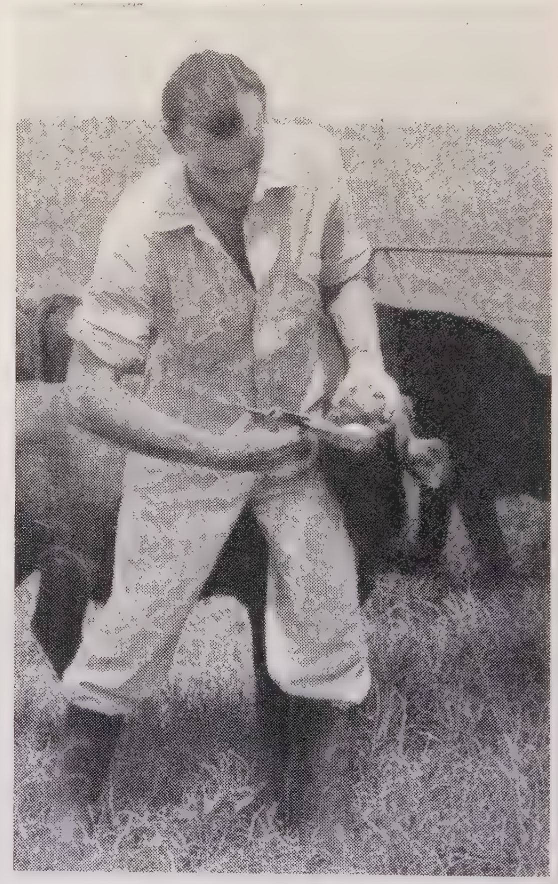

Plate 2

Drenching a Calf with Phenothiazine. This is a frequent and necessary procedure on every dairy. On the day following drenching the urine may be coloured pink or red.

To avoid cottonseed toxicity, the meal should e fed at not greater than 20 per cent. of the ation. It should not be fed to calves under months of age.

5. Nephritis

This term simply means an inflammatory amaging of the kidneys. It may be infective n origin, or toxic.

(*a*) A specific infective type causes a condition called pyelonephritis. This type is very rare in Queensland and in it the kidneys and bladder together with the ureters (tubes from kidneys to bladder) are grossly enlarged and usually filled with a mixture of blood, pus and urine. Affected cows grow very poor, urinate frequently and pass much blood and pus.

In this form of redwater, free blood or blood clots cause the discolouration, and pus is usually an accompanying feature.

General infectious diseases causing fevered states frequently involve the kidney secondarily, and thus redwater may result. Examples also of localised diseases generalising are septic metritis, septic mastitis, infectious enteritis which begin as infections of the uterus, udder and intestines respectively, then generalise by escaping into the bloodstream.

(*b*) Toxic nephritis results from direct toxic action on the kidney from an agent carried via the bloodstream. Sulphonamide and copper poisonings are two of this nature. Prolonged dosing with sulphonamide drugs frequently causes kidney damage with a resultant redwater due to the escape of blood in the urine.

Copper poisoning presents a similar picture and kidneys are severely damaged with the production of a red or even black urine. This type of poisoning is not common but has resulted from grazing through an orchard sprayed with Bordeaux mixture, from accidental overdose drenching with bluestone (copper sulphate) solution for stomach-worm (now superseded, of course) and from overdosing with bluestone in attempting therapy in copper-deficient areas. The

Plate 3

Calves from this Well-Fed Group Died as a Result of Excess Cottonseed-Meal Feeding. The usual pattern was to find the calves dead or for them to die suddenly following signs of a redwater.

latter has recently been encountered in the copper-deficient Beenleigh area, where excessive therapy resulted in the deaths of three calves. Symptoms of chronic copper poisoning (as in this Beenleigh case) closely resemble a leptospirosis outbreak.

6. Miscellaneous Conditions

The following conditions are sporadic in occurrence, not well defined and not clearly explained; hence their inclusion in this category:

(i.) *Post-parturient Haemoglobinuria.*—This is a metabolic disease of high-producing, well-nourished cows on their third or subsequent calf. It seems to be associated with low blood phosphorus levels although this is probably not the only factor. *A simple phosphorus deficiency will not explain this condition.* Symptoms are sudden in onset, with redwater due to blood in the urine, failure to feed for 2 or 3 days, inability to rise, then death in 3 to 5 days.

This disease is very uncommon except in restricted areas.

(ii.) *Cystic Haematuria.*—This condition, also called enzootic haematuria, is associated with poorer type country. It affects both sexes, and features are seen in the bladder, these being large haemorrhages on the inside of the bladder to the extent of being vascular tumours. Later, fibrosis of the bladder walls occurs.

Symptoms are frequent scanty urination together with straining and switching of the tail. Blood is always present to some extent. The affected animal grows very poor, haemorrhage increases and death or destruction follows.

This disease is *not* infectious, *not* transmissible and is rare.

(iii.) *Phosphorus Deficiency.*—This mineral deficiency is thought to be responsible for occasional cases of redwater in different areas throughout Queensland. Phosphorus deficiency will cause ill-thrift, reduced production, and bone conditions as major symptoms. In addition there is a theory which suggests that prolonged phosphorus deficiency is associated with a red blood cell fragility and redwater. This disease and the preceding one (post-parturient haemoglobinuria) tend to have overlapping theories which confuse the picture in each case.

Summing Up

If redwater occurs in adult cattle associated with marked fever, think first of tick fever.

Should lactating cows show a tinge of redwater, together with depressed production and a mild temperature rise, leptospirosis could be involved.

Other acute fevers frequently show transient redwater as a symptom.

In calves, tick fever is rare and any severe redwater with high temperatures and deaths points to leptospirosis as the most likely cause.

Keep phenothiazine in mind; drenched calves may show a subsequent redwater, but they are bright and healthy.

Cottonseed meal feeding of calves has poisoning possibilities at 20 per cent. of the ration, a prominent sign being redwater.

◆

DON'T HARVEST WET COTTON. One aspect of machine picking of cotton that is causing some concern is the quantity of wet cotton received at the ginnery. This cotton has to be heated and dried down to about 7 per cent. moisture before ginning, and the grades of excessively wet cotton suffer in this process.

From observations made over the last few seasons, picking should not be commenced in most districts before 9.30 o'clock in the morning. This allows time for the dew to evaporate from open bolls and leaves.

Some operators have found it possible to work after sundown for several hours before the cotton becomes too wet. But all should avoid picking too early in the morning.—*W. G. Steele, Senior Adviser in Agriculture.*

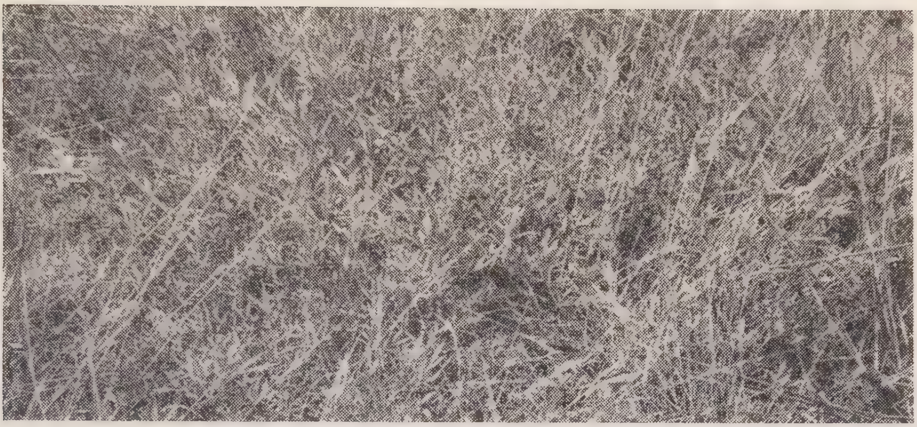

Plate 1: **Townsville Lucerne Growing in Native pastures.**

Townsville Lucerne In The Lockyer Valley

By J. G. FULLERTON, Adviser In Agriculture.

Trials over the past 5 years have demonstrated that Townsville lucerne could prove as valuable on the forest soils of low fertility in the Lockyer Valley as Hunter River lucerne has on the rich alluvial flats.

There is little similarity between Townsville ucerne and Hunter River lucerne. Townsville ucerne (*Stylosanthes humilis*) is an annual ummer-growing legume with a trifoliate leaf which has some slight resemblance to the leaf of he better known Hunter River lucerne. Gener-lly speaking, Townsville lucerne has a prostrate rowth habit, although in association with a heavy ody of grass in trials near Gatton it has grown o a height of 18in. to 24in.

Being an annual it germinates from seed every year, usually when heavy summer rains commence. It flowers by the following April, after which plants die off naturally or may be killed by frost. The small seedlings are unable to compete with a heavy stand of vigorous grass, and the plant does best where the grass cover is light or short grasses such as couch predominate.

For this reason Townsville lucerne has shown ability to grow on poor forest ridge country of low fertility. There is an extensive area of this type of country in the Lockyer Valley, occurring mainly to the north of Lockyer Creek. In its original state, this country is heavily timbered, the most common timber being narrow-leaf ironbark and spotted gum. When cleared for grazing, it is quickly taken over by inferior grasses such as pitted blue grass, with bunch spear grass in less heavily stocked areas.

Very little of this country has been cleared for cultivation, but when this is done, couch grass is a problem and rapidly invades any old cultivation paddock. Under these conditions, Townsville lucerne has shown ability to grow in combination with grass species.

This is similar to findings in northern and coastal parts of the State where this legume grows on poor country carrying a light cover of native grass species which leaves areas of bare ground between plants for the Townsville lucerne to develop.

Grazing Qualities

It has been found that when other green feed is available as is the case when Townsville lucerne is growing, stock will not readily graze the plant in its green state. However, once seeding is completed and the plant commences to "hay-off", cattle will readily graze it. This is an important aspect in the survival and regeneration of the species. It ensures that the plant is not grazed before seeding-down, so that subsequent regeneration can take place.

A further important result of this habit is that Townsville lucerne provides protein-rich grazing at a time when grasses have seeded down and are of low nutritional value.

Analyses of mature plants have shown them to have a crude protein content of 12.4 per cent. on a moisture-free basis. The composition of young and old growth is shown in the following table:

TABLE 1

COMPOSITION OF TOWNSVILLE LUCERNE

Description of Sample	Analysis of Water-free Material						
	Crude Protein	Crude Fat	CHO	Crude Fibre	Ash	CaO	P_2O_5
	%	%	%	%	%	%	%
Young and succulent	14·2	1·0	..	25·9	..	2·500	0·503
Older growth ..	13·5	1·5	..	32·1	..	1·534	0·243

Planting

A firm seedbed with a light cover of soil seems to be the ideal condition for planting. The plant has been established successfully by broadcasting direct into an existing sward of spear grass without prior land preparation. However, as the planting rate of 2 to 4 lb. to the acre gives only a thin stand initially it is advisable to prepare some sort of seedbed. This preparation does not have to be deep or thorough but should ensure that the merging seedlings have a minimum of competition from established grasses.

As the plant is a prolific seeder, subsequent working of the soil is unnecessary: the greater number of seedlings should ensure a good strike. Although the initial stand may be thin, and in a dry summer growth may be light and low, farmers should persevere with this species and encourage its spread by correct management practices. In the first few years following planting, Townsville lucerne should not be grazed during seeding-down, but this is not of such importance when the stand is well established.

Soil Fertility

Townsville lucerne will grow on soils of low fertility. In trials in the Gatton area, no response was obtained to applications of superphosphate and sulphate of ammonia at the rates of 2 cwt. per acre.

Plate 2. **Close Up of a Townsville Lucerne Plant.**

No increase in grass vigour has yet been noticed in grasses growing in association with this legume in the Lockyer but a Departmental trial in the Gympie area showed consistent and significant increases in both overall yield and protein content of grasses grown in association with Townsville lucerne. This will probably occur with time in the Lockyer as stands increase in vigour.

This increased fertility has also been noticed by tobacco growers in north Queensland where less nitrogen must be applied to tobacco growing on land previously carrying a Townsville lucerne sward.

Before planting, seed should be treated with inoculum to ensure satisfactory nodulation of the plants.

Acknowledgements

The co-operation and enthusiasm of Mr. G. Hallas, Gatton, on whose property trials of this legume have been carried out, is gratefully acknowledged.

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Nitrogen Fertilization of Irrigated Pasture. The value of nitrogen-rich fertilizer on clover-grass irrigated pastures, particularly in the early years of development, has been demonstrated in southern Queensland. Confirmation of this practice comes from recent trials in California.

In these trials, a mixed clover-grass irrigated pasture responded to nitrogen in the first season, but nitrogen did not give increased yields in the second year. When grass was grown alone, heavy applications of fertilizer were needed to increase yields. The yields from grass grown alone, however, were lower than the yields from the grass grown in a fertilized clover-grass pasture, indicating the influence of clover on grass growth.

These Californian trials show that fertilization is only one of several important and inter-related management practices—seed mixture sown, irrigation, length of growing periods between grazing—which must be kept in balance to achieve maximum carrying capacity of irrigated pasture.

—*A. NAGLE, Irrigationist.*

Cancer Eye In Beef Cattle

**By G. I. ALEXANDER, Senior Husbandry Officer,
and M. D. McGAVIN, Senior Histopathologist.**

Breeders of Hereford and Poll Hereford cattle in Queensland have all seen the condition known as cancer eye in their cattle at some time. In some areas it seems to occur more frequently than in others and is almost exclusively a problem of these two breeds. The appearance of cancer eye in cattle is more frequent on properties which are closer to the equator, so that Hereford men in the southern states of Australia do not consider it to be a problem. They may have an odd older cow affected, whereas Queensland breeders will find more cows affected and at a younger age.

This type of cancer usually occurs on the eye-lids, eye-ball, or third eye-lid. When it occurs on the eye-lid, which is the commonest site, it is most often found on the lower lid. The most common position on the eye-ball is at the outside edge of the pigmented part of the eye, usually on the edge nearest the animal's ear.

The third eye-lid type is not nearly so common as the other two.

However, red pigment of the skin around the eye will reduce the susceptibility of a cow to the lid type. We have not been able to find animals with cancer of the lid starting in a pigmented area. It will start in a white, non-pigmented area and spread to a pigmented area of the lid. So cows with complete pigmentation of the lids are not susceptible to eyelid cancer.

Unfortunately, we have not been able to find any evidence to show that eye-lid pigmentation will control the appearance of eye-ball cancer. The third eye-lid type has been too rare for us to reach any definite conclusions as to whether eye-lid pigmentation will control it.

On the eye-lid, the first appearance of the early stages which lead to a cancer is that of a hard horny growth with a later appearance of "soreness" or weepiness of the lid. This has been called a "boggy lid" by the Americans. Later an ulcer appears which is really an early cancer

On the eye-ball, the first sign is a small whitish raised lump which looks almost like a small blister. This grows until it finally develops into a full scale cancer.

These cancers develop at very variable rates Some progress very rapidly, going from nothing to an obvious cancer in less than 3 months Others may take a year or 2 to develop. Others tend to disappear and not recur. So it is a little difficult to predict the fate of an early stage with any degree of accuracy. In general, they seem to develop more rapidly during the summer months than during the winter.

Treatment

Treatment of these types of eye cancer is difficult. The only satisfactory way to remove them is to get a veterinarian to remove the eye if the cancer is sufficiently advanced. In early cases with a valuable animal, the small pre-cancerous stages can be trimmed off by a veterinary surgeon. However, these must be in very early stages, before the cancer has commenced to invade normal tissues. The only alternative

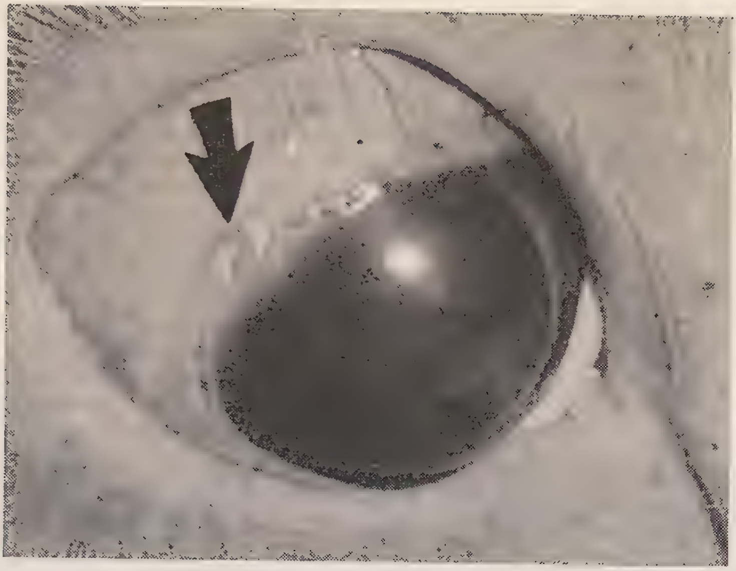


Plate 1

An Early Stage of Growth on the Eyeball.

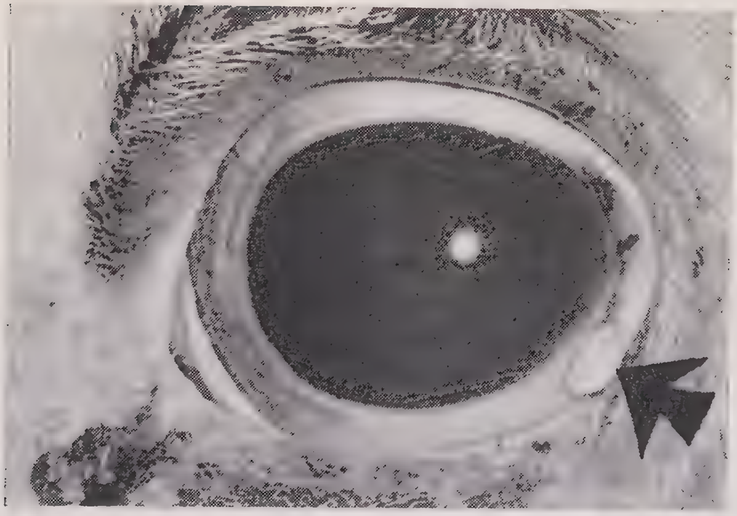


Plate 2

A Later Stage of Pre-Cancerous Growth on the Eyeball.

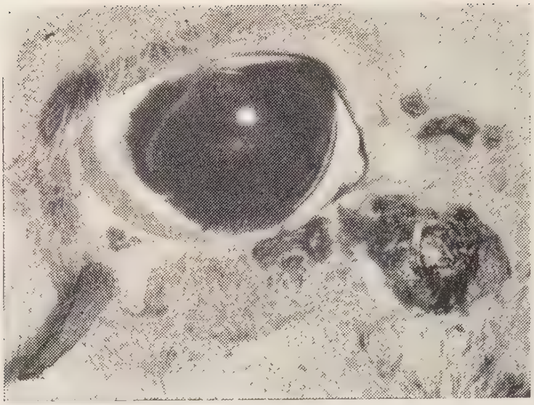


Plate 3

Early Lid Lesions in the Form of Horns and Keratosis.

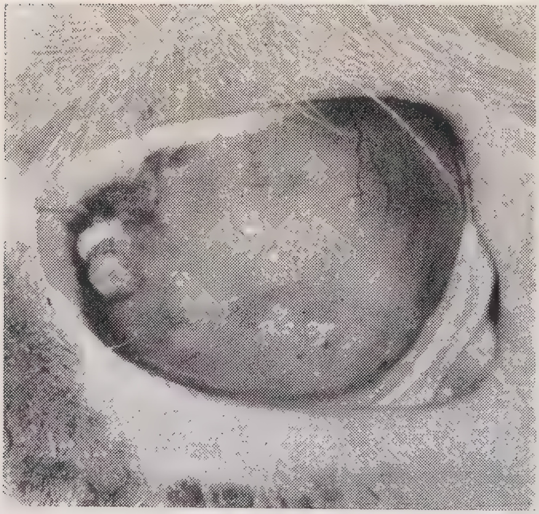


Plate 4

Cancer of the Eyeball. (*Photos by M. D. McGavin*).

to surgical removal is slaughter. If the animal is left too long before surgical removal, the cancerous growth may have spread into the bones of the orbit, and the animal is beyond saving by this means.

Prevention in the case of lid cancer which is by far the commonest type is relatively simple when compared with the eye-ball type. Cattle with full pigmentation of the eye-lid will not get cancer of the eye-lid so that this is the type of animal which a breeder must select if he wants to prevent his cattle developing this type of cancer. However, the situation is more difficult when the eye-ball type is considered. With this there is no ready indicator of susceptibility or resistance which can be used on a calf as in the case of the lid type. It is only when an animal develops early lesions as a mature beast that one can say with any surety that it is susceptible. If it does not develop these early stages, it does not mean that it is not susceptible. It may mean that the animal has not been reared in an area where the condition is so prevalent. This has led many breeders into thinking that their cattle are not so susceptible as other men's cattle to this condition.

The only way that we can evaluate the resistance of different strains of Hereford and Poll Hereford cattle is to rear them under the same conditions. In our observations on commercial herds, we have found no indication that the man who is line-breeding to a particular stud has a greater incidence in his herd than the man who uses bulls from many breeders. So it does not seem very likely that strains of cattle have yet been developed which are resistant to the eye-ball type of eye cancer.

If a breeder could afford to cull any bull showing the condition at under 6 years of age, any cows showing it before 6 years and all their progeny, he could very quickly produce a herd which is more resistant to this condition than others. The susceptibility to this condition is quite highly inherited and so it can be selected against with a high measure of success. However, the culling rate would be particularly high when the breeder started to cull along these lines so that it is doubtful whether many breeders could carry it out and cull for anything else in their herds.

We are endeavouring to determine whether we can find ways of identifying susceptible cattle at an early age, but as yet, we have not had much success.

Plate 1

Close Up of Vigorous, Productive Irrigated Pastures at Redbank.

This Dairyman Has Key To Success

By I. N. McCLEMENT, Agriculture Branch, and A. HUTCHINGS, Cattle Husbandry Branch.

Highly productive pastures are normally associated with fertile alluvial soils but Mr. C. Taylor, of Redbank, has proved that high production can be reached and maintained on second class country. This has been achieved by thorough land preparation, efficient irrigation, successful pasture management and systematic dairy husbandry.

In the spring of 1957, an area of 12 acres was selected, heavily ripped twice and harrowed down to a seed-bed. A mixture of white panicum at 10 lb. per acre and poona cowpea at 20 lb. per acre was planted. Before planting, the area was top-dressed with "Fish 4" fertilizer (4·25: 20:5) at 2 bags to the acre.

The resultant crop provided excellent grazing and kept weed growth in check. Furthermore, soil fertility was increased and the extra workings the ground received resulted in better soil aeration.

After grazing, the residue was ploughed in and the area worked down to a fine seed-bed.

Planting the Irrigated Pastures

During April, 1958, the following mixture was sown:

Ladino white clover	1 lb. per acre
New Zealand white clover	1 lb. per acre
Lucerne	1 lb. per acre
H.1. rye grass	3 lb. per acre
Priebe's perennial prairie	6 lb. per acre
Paspalum	4 lb. per acre

The clovers and lucerne were inoculated immediately before planting to ensure the presence of the correct strains of bacteria for effective nodulation.

Spray irrigation was employed to supply sufficient soil moisture to germinate the seed.

No further fertilizer was applied.

Subsequent Plantings

In 1959, a further 9 acres were sown with the following mixture:

Ladino white clover	1 lb. per acre
New Zealand white clover	1 lb. per acre
Lucerne	1 lb. per acre
H. 1. rye grass	3 lb. per acre
Priebe's perennial prairie	6 lb. per acre
Phalaris arundinacea	2 lb. per acre
Paspalum	4 lb. per acre

Soil preparation, fertilizing and precropping were the same as described for the previous year.

Costs of Seeds and Fertilizer

The costs of seed and fertilizer for the 21 acres were as follows:

	£	*s.*	*d.*	£	*s.*	*d.*
Precropping—						
White panicum	16	6	6			
Poona cow-pea	16	8	0			
Fertilizer	75	0	6			
				107	15	0
Irrigated Pastures—						
Ladino white clover	8	8	0			
New Zealand white clover ..	8	8	0			
Lucerne	5	6	9			
H. 1. rye grass	9	19	6			
Priebe's perennial prairie	19	8	6			
Paspalum	15	5	0			
Phalaris arundinacea (9 acres only)	10	19	0			
				77	14	9
Total 21 acres				185	9	9
Cost per acre				8	16	8

Pasture Management and Rotational Grazing

The 21 acres of irrigated pastures are subdivided into 21 paddocks of approximately equal size. A central laneway, half a chain wide, divides the area and allows easy access to each paddock. Dividing fences are built with light steel posts and 2 barbed wires.

A herd of 84 cows, including dry stock, graze on one block each day. Thus each block has a 21 day spell between grazings.

Some comment might be offered on Mr. Taylor's grazing schedule of a set interval of 21 days irrespective of seasonal growth. This is not usually accepted as a basis of successful management.

The general impression is that unless pasture is grazed closely, production is lost. However, high production has been maintained by Mr. Taylor with his method of lenient grazing under a regular rotation schedule.

Mr. Taylor claims that the success he has achieved by this method is due to the fact that the pasture is not grazed below 4 in., thus ensuring a rapid rate of regrowth.

This lenient defoliation may be of importance for several reasons. It has been shown by work in Queensland that lenient grazing of irrigated pastures during summer plays a major part in reducing soil temperatures and maintaining healthy clover plants. In addition there is the question of possible faster regrowth from less heavily grazed pastures. The importance of leaving sufficient leaf on clover plants to give fast regrowth has been shown at the Waite Institute in South Australia.

Recent work by the Grasslands Division of D.S.I.R. New Zealand, has also demonstrated this on a rye grass, white and red clover pasture. A very pronounced difference occurred in one trial, where, after 14 days, the regrowth of such a pasture grazed back to the 5 in. stage before spelling was twice that of a similar pasture grazed down to the 1 in. stage before spelling.

The New Zealand experiments on the growth rate at various seasons of the year showed that the most favourable yield of herbage would be obtained in the spring anywhere between a minimum height of 4 to 5 in. and a maximum height of 9 to 12 in. In the winter, minimum height would be 3 in. and the maximum height, 8 to 9 in. In other words, the farmer should not allow his pasture to be grazed down below 4 to 5 in. in the spring and 3 in. in the winter if the maximum amount of growth is to be obtained from any particular pasture.

Mr. Taylor's interpretation of this New Zealand work for his conditions should be of great local interest.

Twice a year, in the autumn and spring, the pastures are top-dressed with superphosphate at the rate of 1 bag per acre.

Plate 2

This Cow Is Grazing Vigorous 2-year-old Irrigated Pastures at Redbank.

During the colder winter months, the dairy herd is housed in stalls during the night. Sawdust is used for bedding, and each night's droppings are limed and covered with more sawdust. At the end of the winter, approximately 7½ tons of natural fertilizer are available for spreading on the pastures. In addition to this, droppings from the grazing animals are spread at regular intervals.

Spray irrigation is employed to provide adequate soil moisture. Water is drawn from the Brisbane River, and although the river is subject to tidal influence at the pumping point, no excessive salting occurred during the recent drought conditions.

Originally a 3 in./4 in. centrifugal pump direct coupled to a 25 h.p. electric motor was installed. Five thousand ft. of 6 in. underground fibro main line, delivered the water to a 4 in. aluminium spray line 9 chains long fitted with a medium pressure spray head every length.

In the spring of 1960, a 4 in./5 in. centrifugal pump direct coupled to a 50 h.p. electric motor was installed. This allows Mr. Taylor to operate 20 chains of 4 in. spray line, with provision for longer spray lines if required.

Mr. Taylor has proved that soil moisture is not only important for plant growth but reduces soil temperature in the summer months, thus assisting the growth of the temperate pasture species. Every endeavour is made to keep the moisture supply in the soil well above wilting point.

After each grazing, each block is watered. In the summer months, a second watering is given 7 to 10 days before the block is due to be grazed. In the first instance 3½ in. to 4 in. are applied, and in the second 2 in. to 2½in.

However, Mr. Taylor does not depend on the number of hours his pump operates to determine how much water is applied. As the species of the pasture concentrate the majority of their roots in the top 15 in. of soil, a soil probe is used to test how far the moisture has penetrated. Once the moisture has reached the 15 in. level, the pump is stopped.

Mr. Taylor estimates the cost of applying one acre-inch with the original plant at 4s. 6d.

Herd Management and Controlled Calvings

The 84-cow herd consists of A.I.S. and Jersey cows, a proportion of both breeds being registered.

The bull of each breed is kept. Bulls have been selected from near relatives with high production to increase the potential production of the future herd.

The bulls run in a dryland paddock with the calves and young heifers. They obtain lucerne hay which is continuously provided in a rack. During the period when matings are greatest they are given extra feed in the mating yards.

Hand mating is conducted regularly and a large number of calvings are arranged for the autumn and winter milk supply. These calvings coincide with fast pasture growth when food demands of the freshly calved cows are highest.

Complete breeding records are kept.

The herd is kept in a dry paddock at night and given free access to water and lucerne hay. The 8 hay racks and water are also accessible to cows during the day's grazing on irrigated pasture.

Two pounds of maize meal mixed with a small amount of lucerne chaff are fed regularly during milkings.

Milk production from the herd averaged 160 gal. a day during the past year and summer production averaged 140 gal. while winter production was over 180 gal. daily and reached a peak of 195 gal.

Conservation and Storage

A large well-constructed building provides space for over 500 tons of hay, a large amount of bagged grain, grinding and chaffing machinery, as well as 40 box stalls. The stalls are fitted for complete feeding and drinking during cold or wet weather.

A 20-acre paddock of irrigated lucerne provides up to 100 tons of hay annually for feeding and storage. In addition, hay may be purchased when it is cheap.

Grains are likewise purchased when relatively cheap and stored in bags.

Thus, with a plentiful water supply, careful planning and sound management of all feeds and stock, a prosperous dairy business has been developed in only a few years.

Mr. Taylor's next objective is the same production from 60 cows including dry stock. It incorporates the three principles of good husbandry, feeding, breeding and management, and it is already afoot.

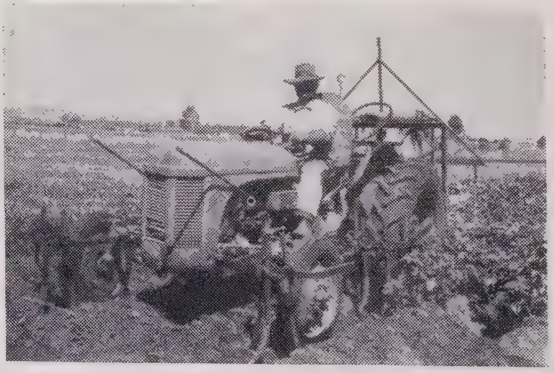
◆

A Crop Divider for Potatoes

The passage of implements through growing crops frequently causes foliar damage and adversely affects yields. Potato crops in advanced stage are particularly vulnerable to damage from the passage of tractor-mounted hilling and spraying equipment.

The home-made equipment shown moves foliage aside very effectively and avoids damage by the tractor wheels. It comprises 1½ in. x 1 in. mild steel bolted to the tractor frame in somewhat the same manner that bumper bars are fixed to a car. Ordinary cultivating tines are clamped to the steel and adjusted according to crop development.

One difficulty has been experienced: in very rough headlands the front tines enter the hard ground deeply enough to bend the bars on which they are mounted. The tines are being replaced by springs strong enough to move the crop as the tractor progresses but able to give way under greater pressure. They are approximately 18 in. long and 1 in. outside diameter and are simply clamped to the main bars.—*C. A. Schroder, Assistant Irrigationist.*



Crop Divider for Potatoes in Action.

Crop Yields Restored By Soil Conservation

By H. S. PINK, Senior Adviser, Soil Conservation.

Eight years' experience with soil conservation activity on his property at Nevilton, in the Clifton district of the Darling Downs, has convinced Mr. W. Lehmann that soil conservation pays.

Concerned at the loss of valuable top soil from erosion during every heavy storm, Mr. Lehmann commenced soil conservation work in 1952. He is now well satisfied with the results achieved.

Mr. Lehmann used to cultivate his farm "round and round" the paddocks. Uncontrolled run-off caused serious erosion—silted fence lines and gullying were the result.

The first step was to plan the farm layout to fit the natural contours of the land. Waterways were constructed on the eastern and southern boundaries and planted to kikuyu grass. When these grass-lined channels were adequately protected, contour banks were built to intercept the flow of run-off water and lead it safely to the waterways.

The farm was completely re-organised by 1955. The sloping land was protected by contour banks and, as the top water was kept under control, the very gently sloping land lower down needed no further protection. Cultivation has been carried out on the contour, and although there are still some irregularities due to old gullies and silted fence lines, Mr. Lehmann says that these are gradually levelling out.

In spite of some poor seasons, he has been able to maintain and in many instances improve his crop yields.

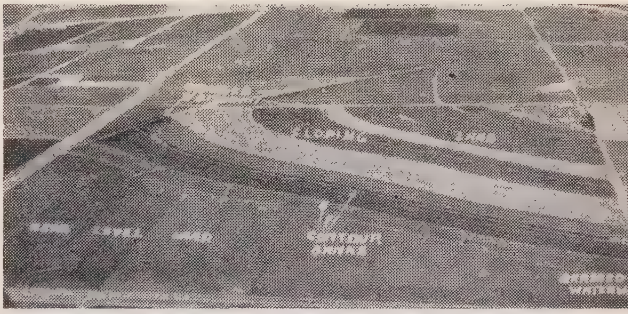


Plate 1

An Aerial View of Mr. Lehmann's Well-Conserved Farm. The usual pattern of squares and rectangles has been changed. The whole farm layout is based on the natural shape of the ground. Sheet and gully erosion may be seen on an adjoining farm.

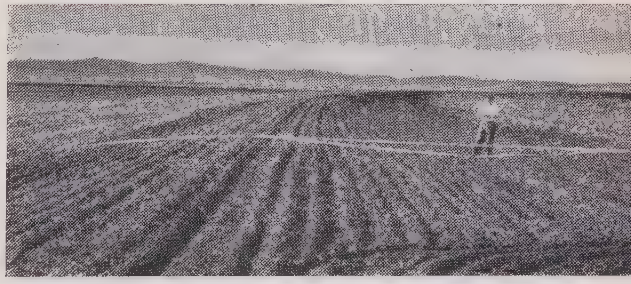


Plate 2

A Broad-Base Contour Bank on Mr. Lehmann's Property. Cultivation is carried out along the bank. Note how each tine leaves a level furrow which helps to temporarily pond water in heavy storms.

He believes that yields from crops on his sloping land now compare favourably with those of other farmers on flat land.

The Lehmann family also enjoys peace of mind during heavy storms. Mr. Lehmann says that before contouring his property a muddy stream raced down the slope during heavy rain. Now, the contour system slows down the run-off, giving the water more time to soak in. The result is that water which can't be absorbed will finally run in a clear stream down his well-grassed kikuyu waterways.

Cultivation and Maintenance

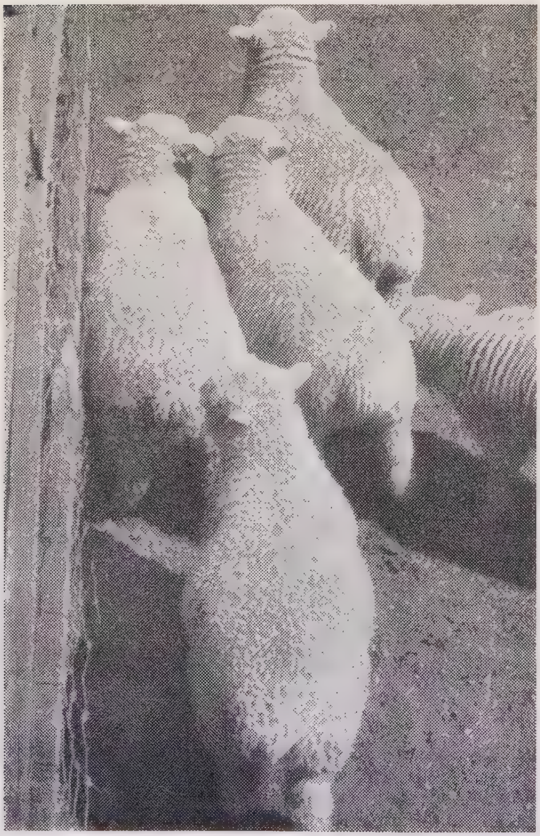
The soil on this property is typical of the black soils in the area. The slope is only moderate and all contour banks are of the broad-base type (Plate 2). A home-made 'dozer blade fitted to his farm tractor kept construction costs down to a minimum. Mr. Lehmann believes in building large banks which he says reduce the need for maintenance. He says his banks will need to be topped up about once in every 4 years.

Stubble on this farm is very seldom burned. It is usually chopped up with a tandem disc and used to help protect the soil surface. The scarifier is Mr. Lehmann's main cultivating implement, but he uses a sundercut when the need arises.

Mr. Lehmann's farm (160 ac.) is used only for grain growing; it is too small for the introduction of stock. He is, therefore, not in a position to know how much improvement would result from the use of pastures and fodder crops. So far, however, he is satisfied that, with care, he can maintain his land in permanent cultivation.

* * * * *

Prime Fat Lambs From the Darling Downs



Note the Great Width Across the Back and Loin of These Lambs. They were a pen of five and their estimated dressed weight was 28 to 36 lb. Sired by Southdown rams from Border Leicester-Merino cross ewes, the lambs came from a Toowoomba district property.

"Green Face" In Capons

By P. D. RANBY, Veterinary Officer.

"Green face" in capons was found to be the result of a bleeding tendency in the birds at the time of caponization.

"Green face" in caponized chickens is not uncommon in Queensland. The disorder appears about 5 days after caponizing and persists for 1 to 2 weeks.

(Caponizing involves injecting a hormone pellet or "implant" under the skin behind the cockerel's head.)

Capons affected by "green face" show a greenish coloration under the skin of the head which is most striking on the relatively unfeathered face. The face is "puffy" and the tissues around the throat become pendulous (see Plate 1). In severe cases, the whole head is swollen.

Actually, if birds in the affected flock are examined carefully, some of the chickens show an intense yellow coloration of the skin, while a few may show both green and yellow areas. However, the yellow face is generally overlooked by the owner as the green faces are much more noticeable.

As there are often a few cases of "green face" after caponizing, and since these recover, poultry farmers are little concerned. However, the disorder sometimes occurs in outbreak proportions and the affected flock suffers a setback. The disorder appears to be more prevalent here in the winter and spring months when dry conditions prevail. Sometimes it is associated with mouldy grain or mash.

What is "green face"? Recent field work on this disorder in Queensland has shown it to be a bleeding or haemorrhagic disease. This was shown in the following outbreak:

In August, 1960, a poultry farmer near Brisbane sought veterinary advice, reporting that his capons had "turned green in the

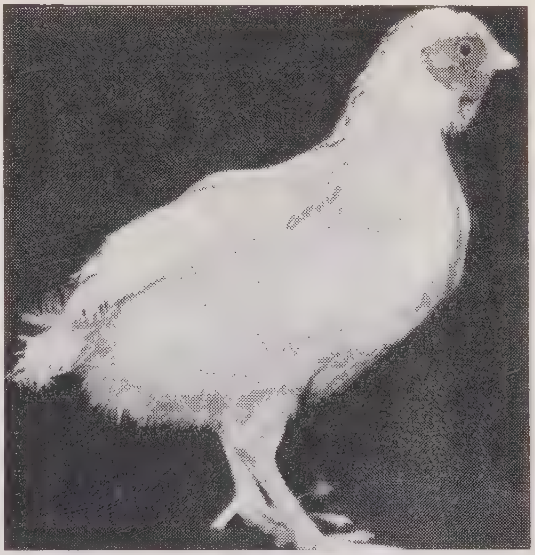


Plate 1

A Case of "Green Face" in a Crossbred Capon 10 days after Chemical Caponising. Note the slight swelling of the head and the more pronounced swelling under the throat. The face is puffy and coloured green. This case was held for several days before photographing it and the symptoms were already starting to wane.

face". About half of the flock of 300 chickens were affected. Many showed extreme swollen heads and green faces when examined on the ninth day. Flock appetite was reduced. Post-mortem examinations on several birds revealed clotted blood over the skull, on the sides of the face and under the throat. The clot extended back as far as the caponizing wound. No bacteria were present. The birds had been caponized with hexoestrol implants of 15 mgm.

The next problem was to explain the bleeding tendency. This was done in a field trial on the next flock of cockerels to be caponized (300 chickens 8 weeks old) on the farm. Half the flock, before caponizing, was medicated for 12 days with vitamins K and E mixed in the mash. (The vitamin mixture contained 0·25 gm. of vitamin K as menadione sodium bisulphite and 1·0 gm. of vitamin E per oz. and was added at the rate of 1 oz. of mixture to 1 cwt. bag of mash). In addition, two types of caponizing pellets were used (15 mgm. hexoestrol pellets as used previously and 15 mgm. diethyl stilboestrol pellets).

The results showed that vitamins K and E prevented the appearance of "green face" while 5 per cent. of the untreated birds developed the condition. There was no difference between the types of caponizing pellets used, indicating these were not implicated. Since the chickens had to be changed from crumbles to mash for the purpose of the trial, the different batch of feed may have been responsible for the lower incidence of "green face".

We now have a clearer picture of "green face". The disorder results from a bleeding tendency due to lack of vitamins K and E. Although these vitamins were not tested separately, we would expect vitamin K to be the main one involved. Vitamin K is required for normal blood clotting while vitamin E is associated with fragility of tiny blood vessels or capillaries. The blood escaping from the caponizing wound collects around the bird's head and under the throat where it finally clots (facial haematoma). As in any blood clot, the red pigment (haemoglobin) breaks down in several days to a yellow pigment (biliverdin), which in turn, takes up oxygen and changes to a green pigment (bilirubin) which corresponds to the green pigment in bile. These pigments would explain the presence of the yellow and green faces seen in these birds.

The prevalence of "green face" in the drier months of the year would correspond with a general tendency to poorer lucerne quality at these times and hence an expected fall in vitamin K content. Lucerne chaff or meal incorporated in the ration is a source of vitamin K for poultry. However, the recent tendency to include synthetic vitamin K (menadione sodium bisulphite) in poultry pre-mixes should prove an answer to the problem of "green face".

◆

Fertilizer for Bean Seed Crops. Applications of nitrogenous fertilizers have given increased yields of seed beans at the Millaroo Regional Experiment Station. During the past 3 years, fertilizer trials have been conducted in conjunction with certified bean seed production.

A typical fertilizer mixture applied by farmers in the Burdekin district would contain 40 lb. of nitrogen, 60 lb. of phosphorus and 10 lb. of potash per acre. By increasing the amount of nitrogen from 40 lb. to 60 lb. per acre yield increases of 3 bus. per acre have been achieved at this Station. This may not seem to be a large increase, but it represents a gain of £12 or more per acre for an outlay of less than £2.

No increase in yield was obtained by increasing the rate of either phosphorus or potash. To ensure a good balance of nutrients the recommended fertilizer should contain 60 lb. nitrogen, 40 lb. phosphorus and 10 lb. potash per acre. This could be obtained by applying 500 lb. per acre of a 12:8:2 mixture. Potash-rich fertilizers will probably reduce the yield of beans.

All fertilizers should be applied either at planting time or shortly after germination—making sure that the fertilizer does not come into contact with the seed. Fertilizer applied later than two weeks after germination is unlikely to improve the yield of bean seed.—*R. W. George, Senior Experimentalist.*

Yellows Disease Threatens Cabbages

By J. C. JOHNSON,
Research Pathologist.

The disease, cabbage yellows, has reached this country, and there is little doubt that it will eventually become widespread.

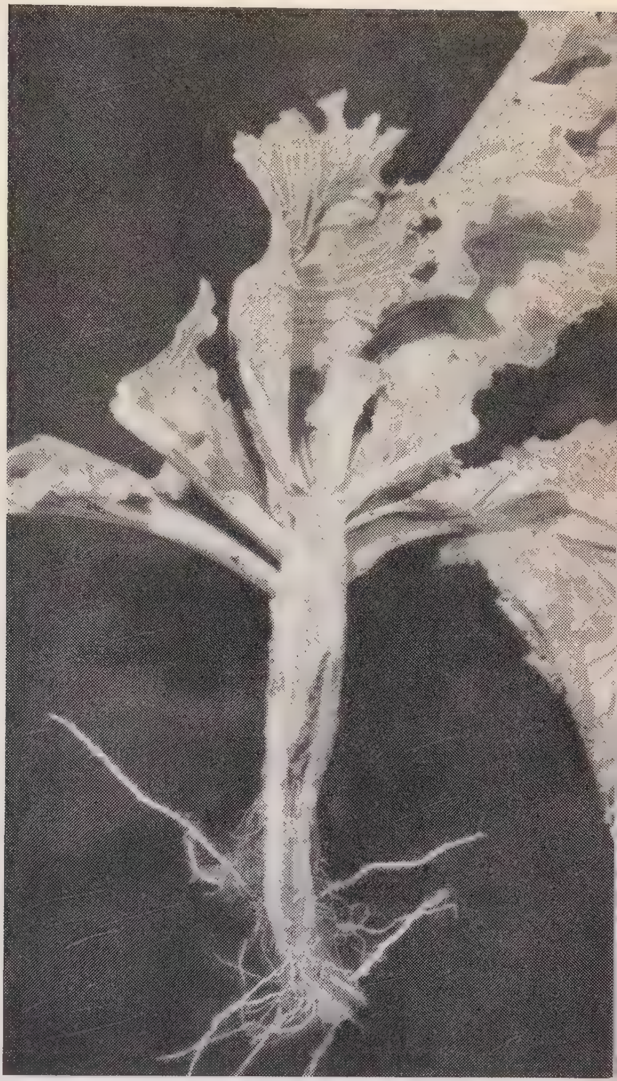


Plate 1: **Cabbage Yellows, Showing Leaf Distortion and Breakdown of Stem.**

Cabbage yellows was first discovered in the United States of America more than 60 years ago. Since then it has become well established throughout that country, causing a serious disorder affecting cabbage crops, especially those grown in warm weather. More recently, it has appeared in a number of other countries, including Canada, China, Cuba, Holland and Japan.

In the spring of 1960, specimens of diseased cabbage from a crop being grown at Ormiston were submitted by C. N. Morgan, Senior Adviser in Horticulture, for examination by Pathology Branch. The symptoms they showed were indicative of yellows, and this was confirmed in subsequent laboratory and glasshouse tests. Thus it appears that the disease has reached this country.

Yellows affects many plants belonging to the cabbage family, including Brussels sprouts, cauliflower, kohl rabi and turnip. The symptoms on all these are somewhat the same. On cabbage, the first indication of infection is a loss of vigour. This is quickly followed by yellowing of the lower leaves. On half-grown plants the leaves

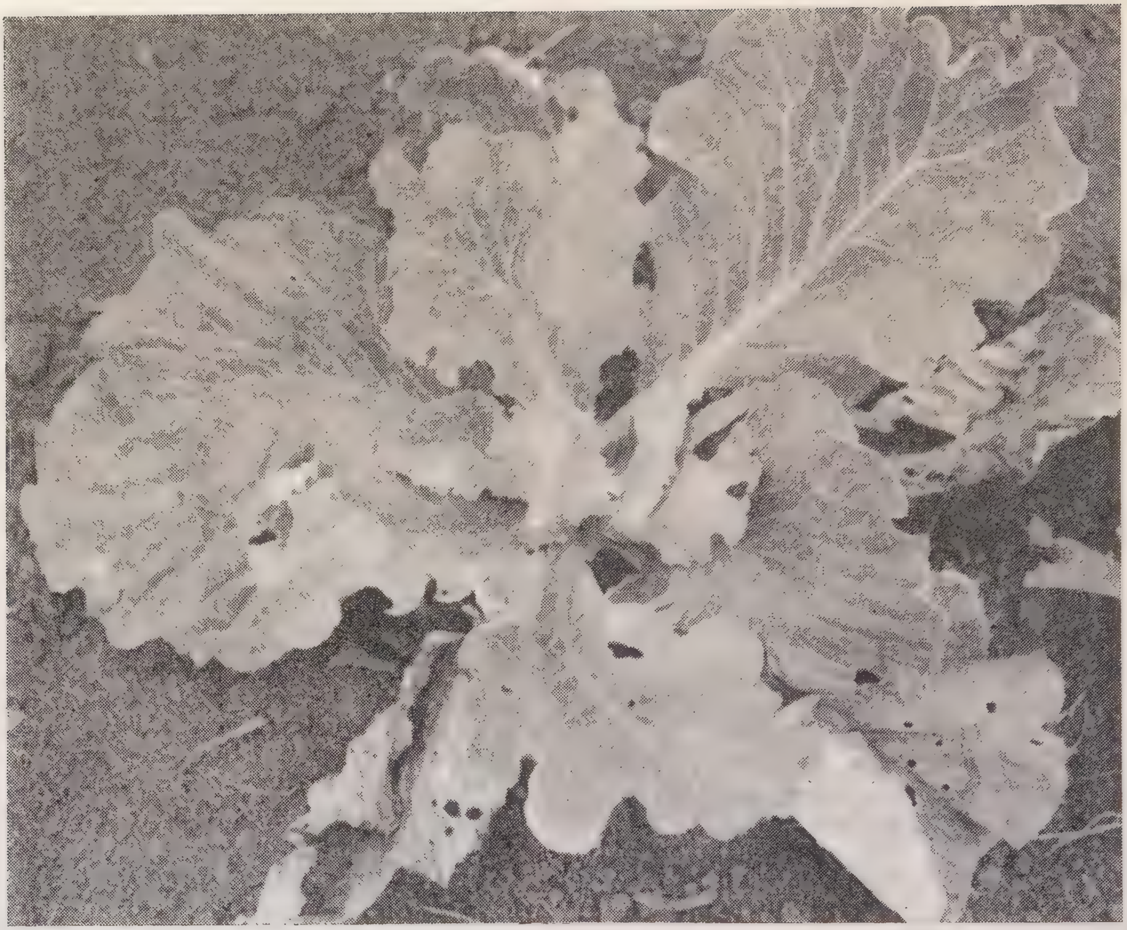


Plate 2

Cabbage Yellows in the Variety Ballhead Hybrid.

may be bent sideways, one side not developing so fast as the other, and the retarded area appearing pale yellow (Plates 1 and 2).

If the stem is cut across at ground level, the water-conducting (woody) tissue surrounding the pith will appear partly or fully discoloured brown. If the plant is split lengthwise this discoloration will be seen to follow these tissues throughout the plant. One-sided development of younger leaves occurs when this browning is more advanced on one side of the stem than on the other.

Plants of all ages are susceptible. The time of infection, however, depends a great deal on the time of planting. Yellows is mainly a warm weather disease since the fungus (*Fusarium oxysporum* f. *conglutinans*) causing it develops best under these conditions. Therefore, early spring plantings may be well advanced before the fungus becomes active. Later plantings will contract the disease at an earlier stage and suffer more acutely. Winter-grown crops may or may not be affected, according to locality.

Once introduced, yellows persists indefinitely in the soil. Crop rotation is not a solution to the problem. It is spread from one part of the farm to another in soil adhering to such things as achinery, tools and shoes of workers. Translanting seedlings from infected soil is a sure eans of spreading the trouble. It is characeristic to find the infection moving along a row ore quickly than it moves sideways into the ext, due to the passage of cultivating implements this direction.

Darkening of the woody stem tissues is common o many wilt diseases caused by fungi of the usarium group. Fusarium wilt of tomatoes, assion vine wilt, and panama disease of banana re other examples. This darkening takes on olours within the range of dark red to brown nd sometimes dark brown. In the case of nfected cabbage the discoloration is mid to dark rown, which is distinct from the grey or black iscoloration caused by black rot. It may also e distinguished from black rot on the grounds hat the discoloured tissue is dry in appearance, hereas that caused by black rot is moist or reasy looking.

esistant Varieties

Fortunately, there is a number of varieties f cabbage that are resistant. Such varieties ere first developed in the United States of merica as long ago as 1916. Since then resistnt forms of a sufficient number of varieties to satisfy the whole of the market there have been developed. The United States Department of Agriculture Farmers' Bulletin No. 1439, dealing with diseases of cabbage, lists 15 such resistant varieties including drumhead, ballhead and sugarloaf types.

Of the varieties available in Queensland at present, 12 were selected as being representative of the more popular, and subjected to resistance tests in which they were artificially inoculated at transplanting with the yellows organism. The results obtained were as shown below, and in Plate 3.

Variety	No. Survivors / No. Inoculated	% Survivors
All Seasons	40/40	100
Utility (Enkhuizen Glory type)	21/39	54
Sugarloaf	9/20	45
Enkhuizen Glory	13/38	34
Ballhead Hybrid	5/30	17
Early Jersey Wakefield ..	3/20	15
First Early Improved ..	4/39	10
Copenhagen Market	0/39	0
Henderson's Succession ..	0/40	0
Vanguard	0/40	0
Green Gold Hybrid	0/20	0

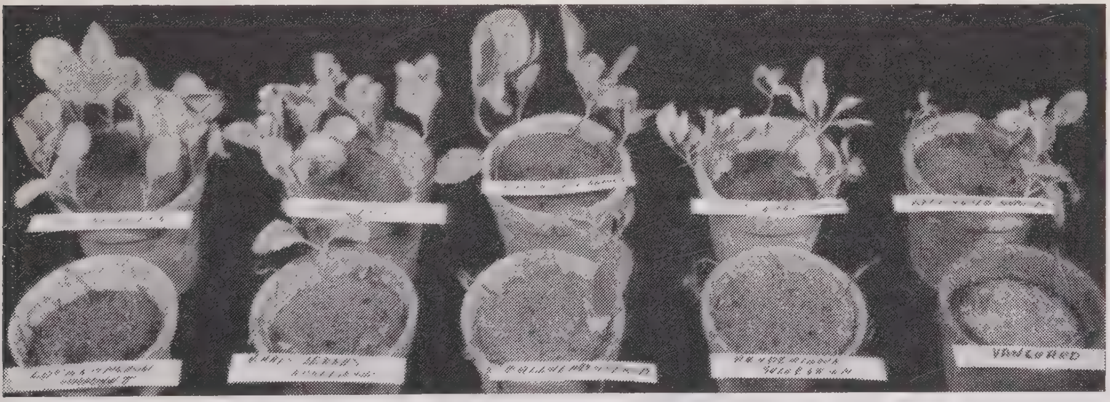


Plate 3

Reaction of 10 Cabbage Varieties to Yellows Disease.

It is apparent that the All Seasons variety used n this test is the only one showing complete esistance to the disease. In 1947, the United tates Department of Agriculture, in co-operation with the Wisconsin Agricultural Experiment Station, released an improved selection of All Seasons named Improved Wisconsin All Seasons. This release was completely resistant to yellows and is probably the original stock from which the test sample was derived. Other samples of All Seasons may not be so resistant.

The test survivors from the Enkhuizen Glory and Early Jersey Wakefield (Sugarloaf) types also appeared to be unaffected by the disease. This means that these varieties too, after selection work, could be improved to the extent of being completely resistant. Two such varieties have in fact been developed by the same authorities. They are Globe and Jersey Queen, released in 1927 and 1932, respectively.

The Ballhead Hybrid sample showed 6 survivors out of 30. The other varieties tested showed no resistant plants.

Yellows is a serious threat to cabbage growing in this country. There is little doubt that it wil eventually become widespread. The situation a present is that the big majority of cabbages being grown are very susceptible. Although mainly a summer trouble, the pathogen is active over a wide range of soil temperatures (60 to 90 deg. F.), and is otherwise adaptable to a wide range of soil conditions.

Once the disease has appeared in a locality, the use of a highly resistant variety will become almost a necessity. Co-operation between seed merchants and State Departments of Agriculture in the introduction, or local development, or these types, and their testing to ensure complete resistance is the obvious method of approach to this new problem.

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Breeds Of Dairy Cattle In Queensland

By Officers of Cattle Husbandry Branch.

The dairy cattle population of Queensland is escended from several breeds, the more importnt of which are Jersey, Guernsey, Australian llawarra Shorthorn and Ayrshire. The Friesian reed is used to a smaller but increasing extent.

Purebreds, grades and numerous kinds of crossbreds and mixtures of these various breeds are found throughout the State, but the Jersey, Australian Illawarra Shorthorn, Ayrshire and Guernsey breeds have been the main contributors to

Plate 1

Champion Jersey Cow at 1958 Royal National Show, Brisbane.

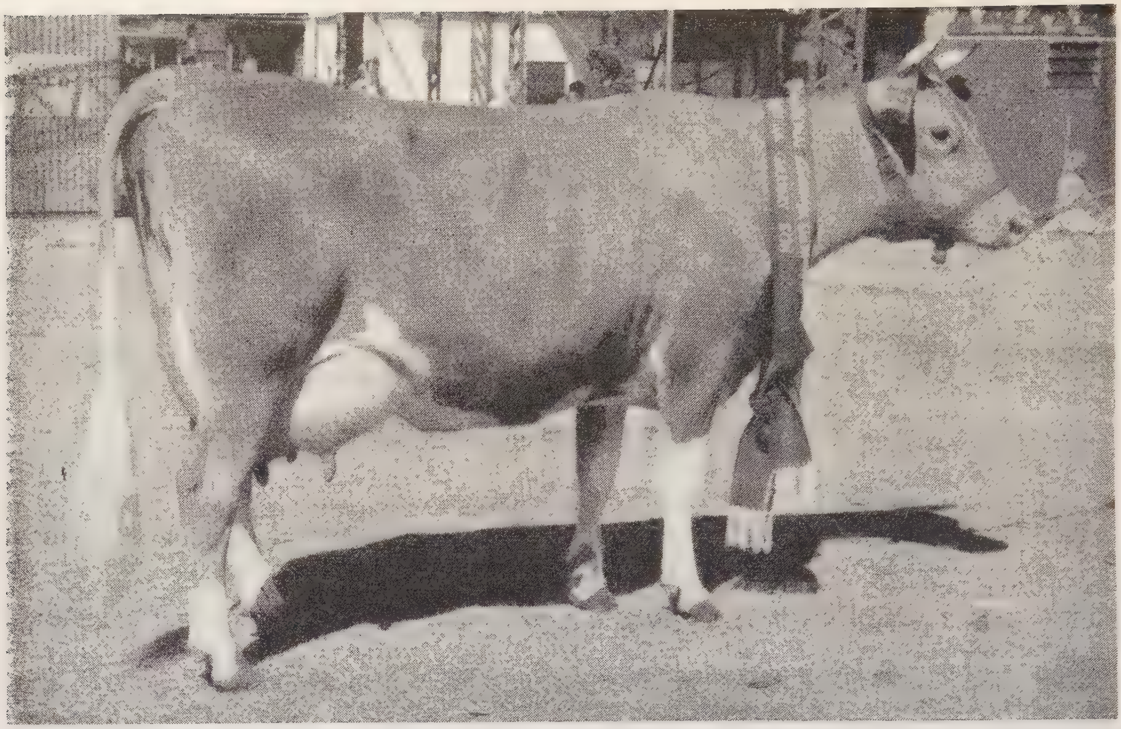


Plate 2
Champion Guernsey Cow at 1959 Royal National Show, Brisbane.

the present-day dairy cow population of Queensland. A.I.S. and Jersey type cattle are by far the most popular.

It is of interest that some Zebu blood has also been introduced in recent years into a few of the dairy cattle of Queensland, but its influence is as yet comparatively slight. The Zebus used have been almost exclusively beef types, but the C.S.I.R.O., the Queensland Department of Agriculture and Stock and the Queensland Agricultural High School and College are investigating the crosses of the temperate dairy breeds with two Indian dairy breeds, the Sahiwal and the Red Sindhi.

Formation of Breed Societies

The use of pedigrees applied to domestic animals began comparatively recently. They were used in England late in the 18th Century and the general formation of breed registry societies began around the middle of the 19th Century.

Robert Bakewell, who lived from 1725 to 1795, is generally credited with setting the pattern and is often called the “founder of animal breeding.” His breeding work was with Longhorn cattle, Leicester sheep and Shire horses, and hi success attracted many imitators. The method he initiated were either applied to foundatio animals obtained from his herds or to what wer then thought to be the best of the local animal It is certain that the Collings family, who lai the foundation of the Shorthorn breed, were i close touch with Bakewell and that men from Herefordshire were also students of his methods Gradually, as a result there began to appear ove England groups of animals related to each othe and similar in type. These were the types from which came the modern breeds, most of which were not formally organised, as such, till later.

While each breed was local, the private record of each breeder were adequate for his own purposes, but in time the number of breeders increase until many were strangers to each other and th number of animal generations in the pedigree increased until no man could remember all of th foundation animals far back in the pedigrees. T supply this knowledge, and also to prevent unscrupulous traders from exporting or selling grades or common stock as purebreds, herd books were formed and breed societies were established.

At present, eight societies are registering dairy cattle in Australia.

The Jersey

The Jersey breed originated on the island of Jersey, one of the Channel Islands group lying a few miles off the French coast. The island is approximately 65 square miles in area with a mild climate.

By the beginning of the 20th Century, there were considerable numbers of Jersey cattle in Australia, and, aided by the activities of the breed societies, the breed made rapid headway.

The Jersey is one of the smallest of cattle, mature cows ranging from 800 to 1,100 lb. and bulls averaging about 1,500 lb. liveweight. The average weight of calves at birth is 50 to 61 lb., bull calves on the average being several pounds heavier than heifer calves.

The true breed type head possesses a typical "dish" between the eyes and also a "dished" appearance when the head is viewed in profile. The cows are noted for their good-shaped, angular udders, free from excess fleshiness and with good strong udder attachments.

The Jersey breed is the most variable in colour; both solid coloured and white spotted individuals occur. The solid coloured animals may be any shade of colour from black to a very light fawn. The muzzle of typical Jerseys is black, encircled by a light coloured area.

Members of the breed are very sensitive and react quickly to external conditions. When they are treated well they respond favourably and quickly and when ill-treated they are equally quick to react unfavourably. The Jersey bull is more likely to be vicious than are bulls of most other breeds.

Jerseys are the earliest of all breeds to mature and are capable of coming into milk production at a very early age. However, to ensure sufficient

Plate 3

Champion Ayrshire Cow at 1959 Royal National Show, Brisbane.

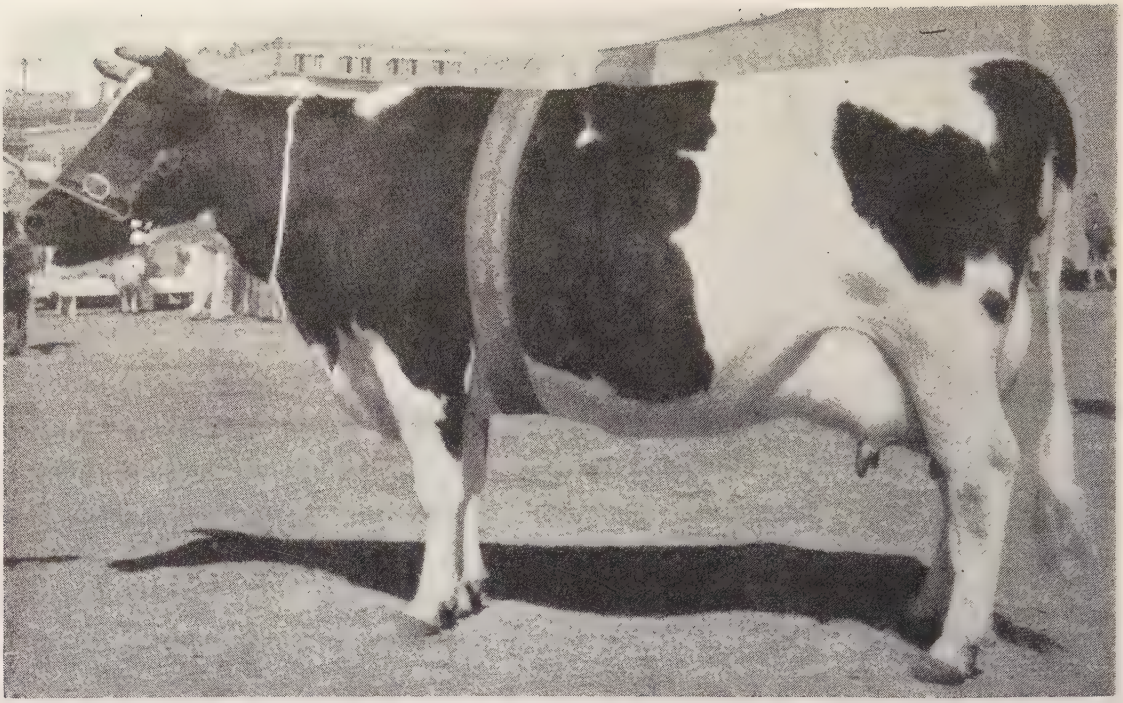


Plate 4

Champion Friesian Cow at 1959 Royal National Show, Brisbane.

body development it is inadvisable for heifers to be mated before they are 15 months of age.

The cows are noted for the quality, rather than the quantity of their milk. The milk is especially rich in fat and total solids content. The range of butterfat content is from 4·0 per cent. to 8·0 per cent., whilst the average for all tested members of the breed in Queensland in 1958-59 is 5·1 per cent. The milk is also rich in carotene, which gives the fat a marked yellow colour. The fat globules are, in addition, relatively large and this results in the cream rising faster than from most other milks. The Jersey generally produces butterfat at a lower cost than do most other breeds because of the high ratio of butterfat to total solids. The Jersey also ranks high in persistency of production throughout the lactation period.

The top producing mature cow of the breed in Queensland up to 1959 produced 14,574 lb. milk with an average butterfat test of 6·8 per cent., yielding a total of 922 lb. butterfat.

The Guernsey

The home of the Guernsey and the site of its development as a breed is the island of Guernsey, a sister island to Jersey, lying 15 miles from the coast of France. The island is only 24 square miles in area with a somewhat colder climate than Jersey Island.

The Guernsey cows vary in weight from about 850 to 1,200 lb., whilst the bulls average about 1,600 lb. liveweight. The average weight of the calves at birth is 65 to 71 lb. The Guernsey resembles the Jersey in many respects, but is larger and the head is not "dished" to the same extent. The Guernsey udders are good, but perhaps a little less symmetrical than those of Jerseys.

The variations in colour are from close to red, called orange, to a very light fawn, with a variable amount of white spotting always present. The white spotting can occur anywhere on the body, but is usually found on the face, legs, flank and switch. The nose is usually buff-coloured. The typical Guernsey has excellent nervous development, being alive and alert yet not so easily excited as the Jersey. Individuals of the breed mature several months later than the average Jersey.

Like the Jersey, the Guernsey breed is noted or the high yellow colouration of the milk and utterfat and the breed possesses the ability to ecrete large proportions of the carotene of the eed into the milk. The fat globules are large nd churn easily. Guernseys rank with Jerseys s producers of low-cost butterfat.

The average percentage of butterfat for the 1958-59 recording year was 4·5. The Guernsey, owever, produces somewhat more milk than does he Jersey. The Guernsey production averages n Queensland in the 1958-59 period were 6,113 b. milk, average test 4·5 per cent., giving a utterfat yield of 272 lb.

The production record for a mature cow of he breed in Queensland is 12,298 lb. milk with a mature cow of the breed in Queensland is a 5·7 per cent. test, giving a total butter production of 694 lb.

The Ayrshire

The youngest of the British dairy breeds common in Australia is the Ayrshire. The chief development of this breed took place after about 1750 in the County of Ayr in south-western Scotland.

The hardiness and foraging ability of the breed are no doubt attributable to the character of the country in which it was developed. The weight of the cows is between 1,000 and 1,300 lb. and that of bulls about 1,750 lb. The calves weigh 70-78 lb. at birth and are strong, vigorous and easy to rear. The Ayrshire is noted for the beauty of its form and also for its long curved horns which add materially to its appearance. Great emphasis has always been laid on the shape of the udder and in this respect the Ayrshire is unexcelled. The average Ayrshire is also more thickly fleshed than either the Jersey or the Guernsey.

The typical Ayrshire is red, with white spotting. The red varies from light red through brown to a colour approaching black, which is usually referred to as mahogany.

Ayrshires are particularly active; the cows are, at times, quite nervous and sometimes hard to

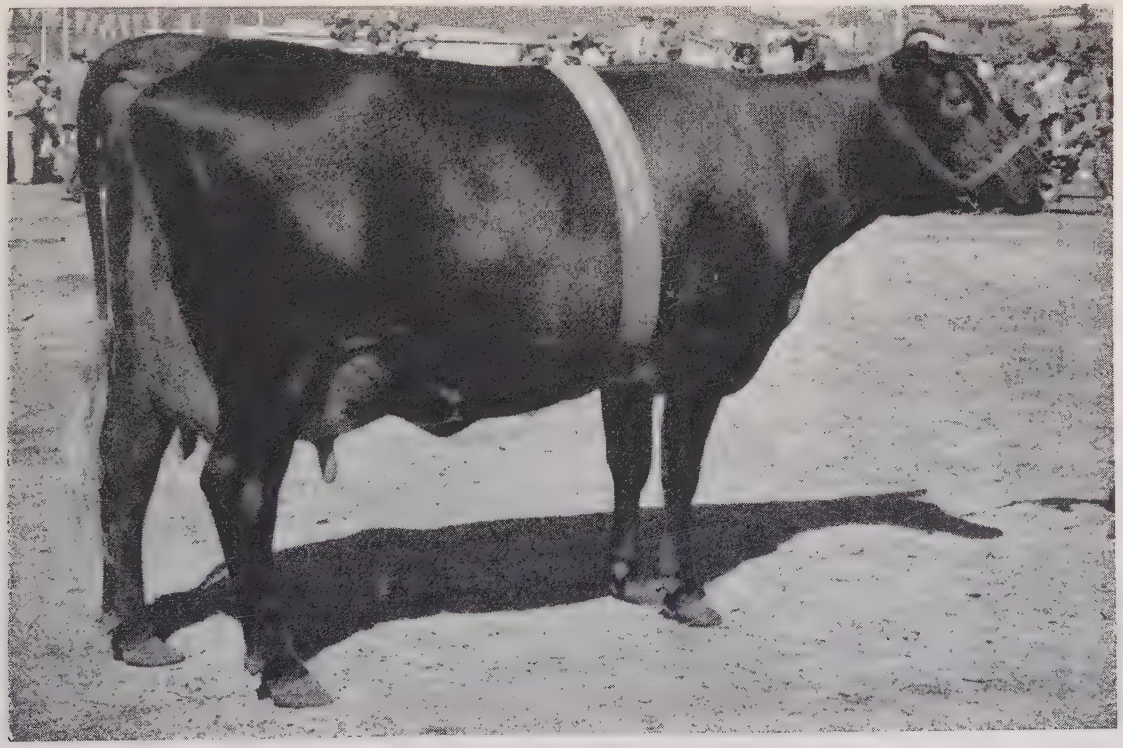


Plate 5

Champion A.I.S. Cow at 1959 Royal National Show, Brisbane.

Plate 6

Sahiwal Bull Used in the Department's Herd at Kairi.

manage, whilst the bulls are frequently vicious in disposition.

Some Ayrshires are somewhat lacking in persistency of production but many are excellent in this respect.

The milk of the Ayrshire gives a fairly high butterfat test combined with high milk yield. The average for Ayrshires in the 1958-59 herd recorded year was 8,175 lb. milk with 4·2 per cent. test, giving 343 lb. butterfat.

Ayrshire milk is claimed to be well suited for infant and invalid feeding because of the size of the fat globules, which are smaller than those of the milks of other breeds.

The average Ayrshire is somewhat slower in reaching maturity than the Guernsey and slightly earlier than the Friesian. Maximum weight and production are usually attained at about six years of age.

The production record for an Ayrshire in Queensland is 14,159 lb. milk with a 5·1 per cent. test, yielding 726 lb. butterfat.

The Friesian

The Friesian breed of cattle was developed in two provinces of Holland—North Holland and West Friesland—where these cattle have been bred for nearly 2,000 years. The breed is also called the Holstein or Holstein-Friesian. The Friesian is the largest of the dairy breeds common in Australia. Mature cows weigh between 1,200 and 1,500 lb. whilst the bulls average around 1,800 lb. liveweight. The calves are strong and vigorous and at birth usually weigh between 93 and 100 lb.

The colour of the breed is, typically, black and white, varying from nearly all black to nearly all white. Solid black and solid white individuals are not preferred, nor are animals showing patches of red, brown or dun. However, red and white animals appear to be common in Holland. The witch is always white.

Friesians are ruggedly built, with large capacious udders and with the head long and straight n profile. They are late maturing animals, attaining maximum growth and development at about seven years of age. The cow is phlegmatic and docile and this character is undoubtedly due o the environment in which the breed was leveloped.

The low butterfat test of Friesian milk in Ausralia has been the greatest handicap to the breed's levelopment in Australia. The low test of some Friesians has given rise to a serious problem in supplying market milk where a minimum fat content is demanded, as is the case with Brisbane's whole milk supply, where a standard of 3·3 per cent., is necessary. However, imported Friesians have a higher butterfat test and should mprove the breed in this respect.

The average percentage of butterfat of all animals of the breed in Queensland during 1958-59 was 3·4 per cent. Friesian milk and butter are generally pale in colour, apparently due to the conversion of the carotene of the feed into colourless vitamin A. The fat globules are also small and this, combined with the low fat content of the liberal and copious milk flow, renders the breed well suited to cheese production areas.

The record 300-day production for a mature cow in Queensland is 19,315 lb. milk with 3·4 per cent. test, giving 657 lb. butterfat.

The Australian Illawarra Shorthorn

The A.I.S. is the only breed of dairy cattle of Australian origin and is named, appropriately, after the oldest dairying district in the Commonwealth, where it was developed about the middle of last century.

The breed, as it is constituted today, is a synthesis of the Shorthorn and Longhorn cattle, with the addition of Ayrshire, and, perhaps, also Devon cattle. The foundation Shorthorn type was largely the milking Shorthorn.

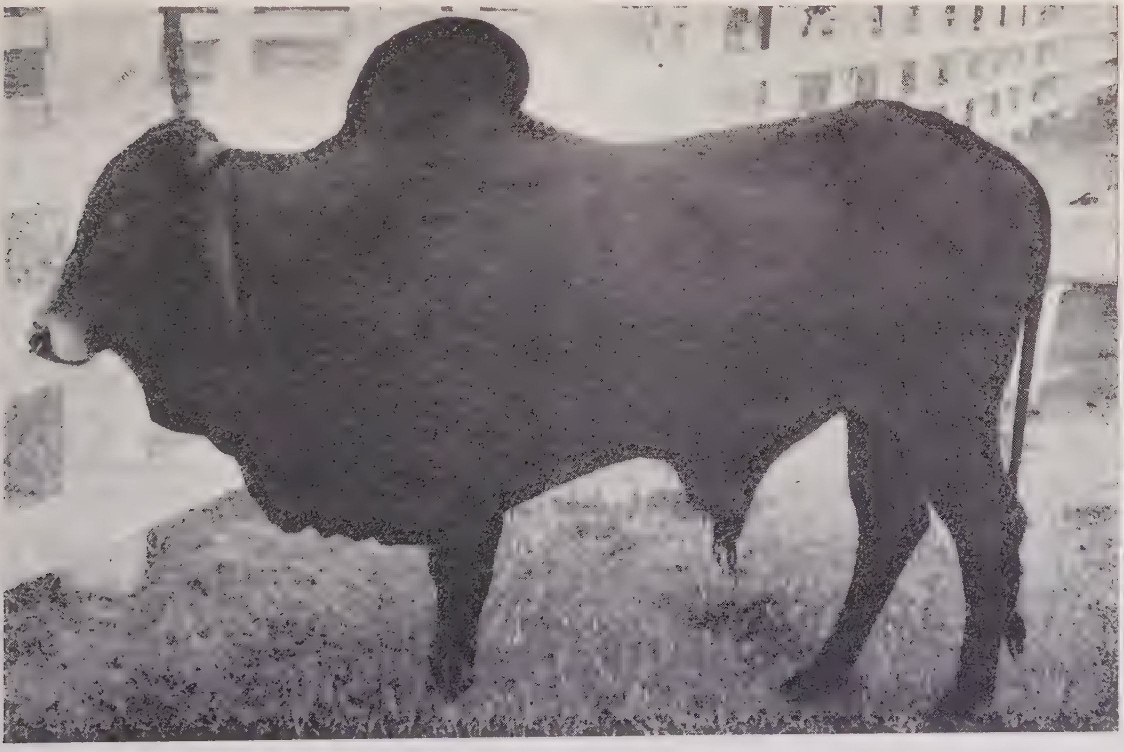


Plate 7

Red Sindhi Bull in Use at Gatton College.

Mature cows of the A.I.S. breed average 1,100 to 1,300 lb. in weight, and bulls weigh about 1,750 lb. The calves at birth are vigorous and active and weigh between 70 lb. and 75 lb. They are easier to rear than calves of some of the lighter breeds.

The dominant colour of the breed is red, ranging from dark red through the lighter reds, with roan animals also common. Broken coloured and practically solid red animals occur.

Many members of the breed commonly lack persistency, producing initially a large volume of milk and then rapidly declining in output. Just how far this characteristic is due to the environmental effects of the feed supply and how far to inherent characters of the breed is unknown. Active steps are being taken to select against this characteristic.

In temperament, the breed is notably docile and tractable and the animals are not easily disturbed by human activities. The udders of the females, although perhaps not displaying the neatness and refinement of the Jersey and Ayrshire, are nevertheless usually capacious and possess large teats.

The breed is widely distributed throughout all the dairying districts of Queensland and is numerically the most popular in this State.

The average 300-day production figures for all officially tested members of the breed in Queensland in the 1958-59 recording year are: 7,193 lb. milk; 4·0 per cent. test and 287 lb. butterfat.

The State record production for a 300-day lactation period for a mature cow of this breed is 19,524 lb. milk, 4·8 per cent. test and 945 lb. butterfat.

The Sahiwal

The Sahiwal breed originated in the dry central and southern area of the Punjab in Pakistan. The breed is also known as the Montgomery breed. The animals are usually long, deep, rather fleshy, short of leg, and comparatively lethargic and heavily built. They are commonly of a reddish dun colour, but many are pale red, while dark brown and almost black colourings, splashed with white, are occasionally seen.

The udder is generally large, pliable, firmly suspended from the body and not fleshy, although pendulous udders are not uncommon. In the Punjab the average yield of cows which are reasonably fed, is about 5,000 lb. milk with a butterfat test ranging from 4·3 to 6 per cent. The production of carefully selected individuals average about 9,000 lb. of milk in 300 days.

The average calving interval is about 15 months. Well-fed heifers calve for the first time when they are between 2½ and 3 years of age. The average weight of mature cows is about 900 lb. and bulls about 1,200 lb.

This breed has been crossed with the Jersey in Jamaica to produce a breed known as the Jamaica Hope. The present level of production in this new breed is about 6,000 lb. milk with a 4·7 per cent. butterfat test. Superior representatives of the breed have produced over 7,000 lb. milk with 5·0 per cent. test.

The Red Sindhi

The Red Sindhi breed of cattle was developed in the districts of Karachi and Hyderabad and is similar in many respects to the Sahiwal breed of the Punjab. As a rule, they are small in size. Their comparative smallness is appreciated in areas where large animals are not needed and they are reputed to have a capacity to adapt themselves to varying conditions of soil and climate.

The Sindhi cattle have a deep, compact frame, with round dropping quarters. They are red in colour, the shades varying from dark red to dun yellow. The average weight of calves at birth is about 40 to 45 lb. for females and 42 to 48 lb. for males. Mature cows weigh about 650 to 700 lb. while bulls weigh 950 to 1,000 lb.

This breed is primarily used in India and Pakistan for milk production, the average production of the breed being about 3,500 lb. milk with some animals registering over 12,000 lb. milk. The average butterfat content has been estimated to be about 4·9 per cent.

Crosses between this breed and European breeds have been used in India and the United States of America.

Queensland Fauna Sanctuaries

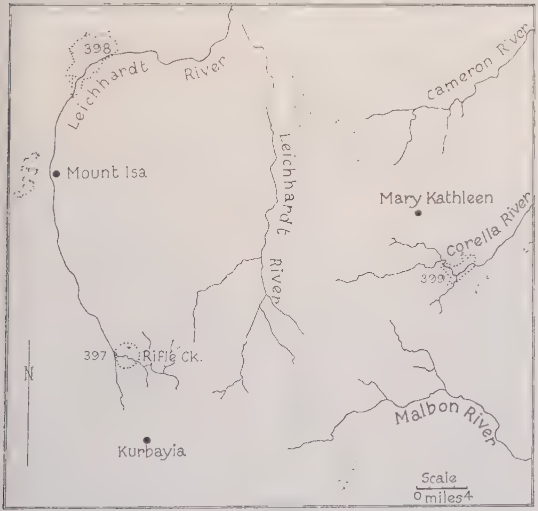
By C. ROFF, Fauna Officer.

The following is an index of the sanctuaries outlined in Map 30:

Index No.	Sanctuary	Area in Acres
397	Rifle Creek Dam, Mount Isa	2,000
398	Leichhardt River Dam Sanctuary, Mount Isa	6,708
399	Lake Corella Sanctuary, Mary Kathleen	1,865

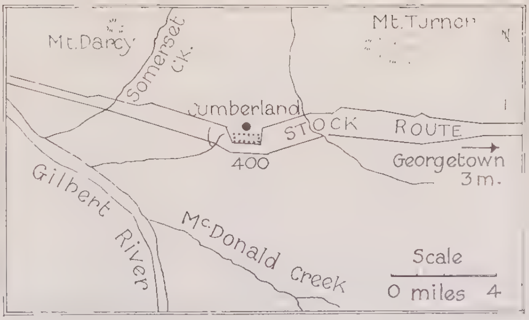
The following is a sanctuary outlined in Map 31:

Index No.	Sanctuary	Area in Acres
400	Cumberland Dam on the Etheridge Goldfield, via Georgetown	132


398
Leichhardt River
Cameron River
Mount Isa
Leichhardt River
Mary Kathleen
Corella River
399
397
Rifle Ck.
N
Malbon River
Kurbayia
Scale
0 miles 4

Map 30

Map Showing Sanctuaries in Part of Fauna District No. 6. The sanctuary boundaries (as at December 31, 1958) are delineated by dotted lines enclosing the stippled areas.


Mt. Darcy
Somerset Ck.
Mt. Turner
N
Cumberland
STOCK ROUTE
400
Georgetown 3 m.
Gilbert River
McDonald Creek
Scale
0 miles 4

Map 31

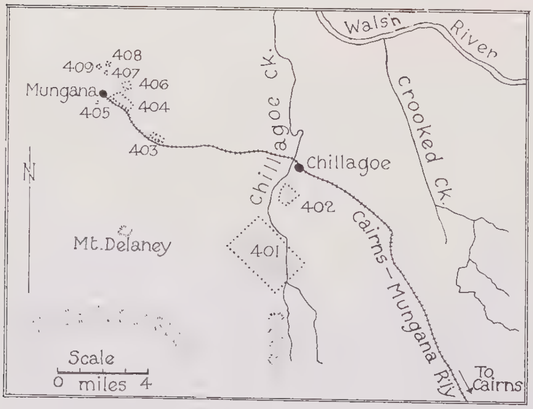
Map Showing a Sanctuary in Part of Fauna District No. 6. The sanctuary boundary (as at December 31, 1957) is delineated by dotted lines enclosing the stippled area.

The following is an index of the sanctuaries outlined in Map 32:

Index No.	Sanctuary	Area in Acres
401	" Marcius Royal Arch Caves," National Park Reserve 13, parish of Chillagoe, via Chillagoe	3,840
402	" Donor's and Tower of London Caves," National Park Reserve 14, parish of Chillagoe, via Chillagoe	440
403	" Geck and Spring Caves," National Park Reserve 92, parish of Chillagoe, via Mungana	86
404	" Jubilee and Piano Caves," National Park Reserve 30, parish of Chillagoe, via Mungana	310
405	" Eclipse Cave," National Park Reserve 95, parish of Chillagoe, via Mungana	2
406	" Cathedral Caves," National Park Reserve 91, parish of Chillagoe, via Mungana	2
407	" Markham Cave," National Park Reserve 97, parish of Chillagoe, via Mungana	2
408	" Royal Archway Cave," National Park Reserve 98, parish of Chillagoe, via Mungana ..	2
409	" Ryan Imperial Cave," National Park Reserve 96, parish of Chillagoe, via Mungana ..	2

Plate 17

Leichhardt River Dam Sanctuary, Mount Isa.


Walsh River
Crooked Ck.
Chillagoe Ck.
408
409
407
406
Mungana
404
405
403
N
Chillagoe
402
Cairns–Mungana Rly
Mt. Delaney
401
Scale
0 miles 4
To Cairns

Map 32

Map Showing Sanctuaries in Part of Fauna District No. 6. The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines enclosing the stippled areas.

Plate 18

Lake Corella Sanctuary, Mary Kathleen.

ashion and Style

With the beginning of each new season appears new fashion—or is it style?

When we asked Miss Nancy Foskett, Senior xtension Officer (Women's Service), New South ales Department of Agriculture, just which it as, she recalled that she had read "fashion is mething we buy, but style is what we give the ings we wear."

Miss Foskett thinks this is worth remember-g and aiming for, and went on to comment ore fully.

Fashion can be regarded as that which is pular at the present time—"in fashion."

Those who follow the newest trends are said be fashionable or in vogue.

Those who choose distinctive clothes and ccessories which increase their attraction, are ose who may be described as having **style.**

The women, and men too for that matter, who nploy judgment and skill in adapting the best fashion to their own needs may achieve true egance and distinction.

High style is the term which refers to the ewest fashion.

It is the unusual and generally the expensive hich only a few people can afford.

If a high style is good, and meets the needs many people, it may become a classic.

Classic style is one which has good line—is ncluttered, and may be worn year after year.

A plain basic dress or suit, and plain pump oes are examples of a classic style.

Fads are those things which remain in fashion nly a short time, and are adopted by only a w people.

It is well to remember that while some fads an be practical they will often detract from the otal appearance.

Good taste may be regarded as the ability to ealise the importance of wearing the right clothes r the occasion, and for the individual.

pproach to a Job

By asking ourselves whether any parts of a b can be eliminated, or combined, we often ome up with improvements to a job, or a day's ork, that result in a reduction of time and energy sed.

Here are some of the questions which make good "starters" when we're trying to find out "what we do with our time".

You'll be able to add many to this list once you start.

Do you:

- Get rid of unused or unnecessary things?
- Keep cleaning supplies within easy reach of the bathtub?
- Store things——whatever they be—where they are first needed?
- Provide low hooks and storage facilities that children can reach and use?
- Provide storage near outside doors for coats and boots?
- Provide enough hanging space for bath towels?
- Have a place for toys where they are used?
- Put a laundry bag in each bedroom?
- Have a waste paper basket in each room?
- Sometimes use ready-mix and quick mix methods?

- Keep up-to-date with improved methods, supplies, equipment, fabrics, cleaners, etc.? Do you use those which suit your needs?
- Hang and fold clothes to be ironed so they won't be more creased?
- Remember that "a stitch in time" really *does* save nine?
- Use easy-care fabrics and easy-to-iron styles for everyday clothes for all the family?

Using Cleaning Fluid

Here are some handy hints on the use of cleaning fluids—when removing stains from clothes:—

Great care should be taken when using cleaning fluid.

Most cleaning fluids are very inflammable.

They should not be stored in a hot place nor used near a stove or fire—which is a temptation in the winter—and should not be used near a hot iron, particularly a petrol iron.

Even electric irons may be dangerous if attempts are made to hurry up the preparation of the garment by trying to "iron the stain dry."

Gas ranges, electric radiators, and cigarettes are also hazards, and the friction caused by briskly rubbing certain materials has been sufficient to generate enough heat to cause the vapour of the cleaner to burst into flame.

The fluid must be used sparingly; the bottle or container should not be left uncorked.

A garment should be left hanging in the open after it has been treated, until the cleaning agent has evaporated and all odour has left it.

Carbon tetrachloride, a most effective cleaning agent which leaves a minimum of "ring" around the cleaned part, is not inflammable but its fumes may affect the person using it.

It should not be used in an enclosed space.

The rings and spots often left when removing stains may be prevented if the following rules are observed:—

Moisten the edge of the stain with cold water; place the stained part over a pad of clean, absorbent rag or clean blotting paper; apply the remover lightly with a circular motion, starting well outside the stain and working inwards with each circle; use the cleaner sparingly; dry the work rapidly, blowing on it and soaking up as much cleaner as possible with a dry cloth.

Buying Furniture

Now that winter is with us again many of u are reminded of the extra chair, table, or boo shelves we were definitely going to buy befor this winter.

For those who have hesitated because of uncertainty of what to buy from the wide range now available, the following hints may be helpful.

In order to shop well for any item of furniture however small, four factors should be considered

Appreciation of line, texture and colour ar matters of personal taste but it is important tha any new furnishing fits in with what one has.

Some contemporary pieces fit in quite happil with traditional designs—a little more care i needed when selecting however.

Money can be wasted unless the exact functio of the piece wanted is considered.

It is easy to make a mistake when buying bed or a chair if we do not consider the size o the person who will use it.

Storage cupboards can be almost useless unles the size and shape of articles to be stored is considered, for example, china and glass, toys, skis books, camp beds, clothing, house linen.

Quality of the article can be judged up to certain point.

Externally, locks should be tested, doors ca be examined to see if they close correctl drawers to see if they run smoothly, tables to se if they are rickety, and upholstery fabrics fo wearing qualities.

The quality of some synthetics and plastic and of invisible items such as springs and webbing cannot be examined—we must rely on th standards and reputation of the manufacturer an the retailer.

Articles that will take a lot of wear, such a mattresses, chests of drawers, upholstered pieces bed springs, require more to be spent on them but something which will not receive this demand can be purchased more cheaply.

If the following questions are answered befor you go shopping, many of the problems will be resolved and a clearer course of action will result

1. How many people are there in the famil and of what age and sex?
2. Is the family permanently settled in the home, or does it move about a lot?

3. Is the housework done wholly or partly by the housewife?
4. Are there household pets and young children?
5. What kind of, and how much, home entertaining is done?
6. What kind of, and how much, family recreation is there?
7. What are the important hobbies which may affect choosing furniture?
8. Are there any styles which are loved or hated?
9. What furniture is owned already?
10. How much money has been set aside for buying new furniture?

Keeping Baby Safe

The care which some people protect precious ewels and material possessions often far exceeds hat which is taken of a helpless, but active and ften wily, babe.

The rules of safety for child care are simple nd well-known—they are mostly obvious and ommon sense, but still babies are injured—and ometimes fatally.

The Women's Service of the New South Wales epartment of Agriculture lists the following as reminder to parents, relatives and friends of H.H. The Baby":—

- Always put cold water in the bath first, and be sure to test the temperature of the water.
- Give baby a cot of his own without a pillow.
- Put on the brake before you leave the pram.
- Use a safety net on the pram as protection from insects, cats, &c.
- See that drop-side cot conforms with safety regulations.
- When baby can sit up, use a safety harness in pram and chair.
- Always use fireguards.
- With toys, see that there are no glass eyes or fluff to swallow, and no poisonous dyes to come off.
- Turn in the handles of all saucepans.
- Put dangerous things out of reach—especially drugs, knives, scissors.
- Avoid slippery floors and sliding mats.
- Put safety bars on upstairs windows.
- Fix safety gate to top of stairs and steps.
- Guard electric points and trailing flex.
- Don't have hanging tablecloths, and don't put containers of boiling fluids near the edges of tables.

Washing Pillows

Feather "crumb" and "foam" types of pillows can be washed at home with good results:

Feather Pillows—

- Wait for a sunny, breezy day.
- If the sink or tub is not big enough it might be easier to use the bath.
- Knead and squeeze the pillow in warm, soapy water and rinse well in waters of similar temperatures until the water is clear.
- Squeeze out as much water as possible. It is not advisable to use the wringer as the pressure could damage the feathers and split the ticking.
- Hang the pillow out of doors if possible, tying two of the corners with string to a line.
- Shake occasionally during drying to fluff up the feathers.
- Air well before re-use.

Crumb and Foam Rubber—

These types of pillows should not be dry cleaned as they may be damaged by chemical solvents.

- They should be kneaded gently in a weak solution of warm, soapy water.
- Avoid the use of soapless detergents or strong soap powders.
- Rinse thoroughly in warm water, then squeeze out the moisture very gently. Do not use a wringer as the pressure might collapse the cells.
- Dry on a towel in an airing cupboard or warm room away from direct heat or sunlight.—*N.S.W. Dept. of Agriculture's "Press Notes".*

Brucellosis-Tested Swine Herds (As at 19th June, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilson Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., "Topcamp", via Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Baker, R. L., "Baroma", Glenapp, via Rathdowney
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Coulsen, B. L. R., Wondai
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
Glasser, D. H., "Yagaburne", Goondiwindi
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warree", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Moorang, via Rosewo
Mack, A. J., "Culzeen", Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Pigger Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Sedgwick, F. G. & J. I. E., Mundubbera
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Home For Boys, "Canaan" Stu Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Ashwell, J., "Green Hill", Felton South
Cooper, G. J., Neumgua
Coulsen, B. L. R., Wondai
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn," M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzeen", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Alexander, Lunde, "Vanda", Biddeston
Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Coulsen, Mrs. H. M., Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jarvis, O., Wondai
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., "Topcamp", via Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton," M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Port Curtis Co-op. Dairy Assn. Ltd., Stud Piggery, Biloela
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Using Urea In The Feeding Of Cattle

By Officers of the Division of Animal Industry

For many years now there has been a world shortage of protein and its principal component, nitrogen.

Towards the end of the last century it was realised that various sources of non-protein nitrogen (N.P.N.) might be used in food for ruminants. Since then much work has been done on this subject, with a stimulus being provided in the 1914-18 war when protein was in very short supply in Germany.

Various forms of N.P.N. have been tested in rations for ruminants, the more important being urea, sodium nitrate and ammonium sulphate. However, more work has been done on urea than on other forms of N.P.N. because of the ready availability of the material from which it is formed and its high content of nitrogen.

Nitrogen is the essential element in protein, which in turn is a necessary part of an animal's diet. The essential function of urea is to provide nitrogen to replace protein. However, urea cannot fully replace the nitrogen of protein because protein has a much higher energy value than urea. This is one reason why carbohydrate is commonly fed in conjunction with urea. Normally, in a ration, as the amount of protein which is replaced by urea increases, the use of urea by the ruminant decreases. This is one of the reasons for the general recommendation in the United States of America to limit urea to 1 per cent. of the total ration, 5 per cent. of a protein supplement and not more than 30 per cent. of the total nitrogen of a ration.

The following table compares urea with some protein supplements on the basis of total nitrogen content:

TABLE 1

Urea	Linseed Meal (28% Digestible Protein)		Peanut Meal (35% Digestible Protein)		Meat-and-bone (45% Digestible Protein) Meal	
Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.
1	0	9	0	7	0	5½
2	1	2	0	14	0	11
3	1¾	0	1¼	0	1	0

Metabolism

In the rumen or paunch, urea is broken down to ammonia by certain bacteria. As this ammonia is being produced it is being used by other bacteria to make protein for inclusion in their body composition. The percentage of ammonia that is converted to bacterial protein depends on the rate of ammonia production, which in turn depends on the rate at which the urea enters the rumen. If the urea enters too rapidly, the bacteria cannot use all the ammonia which is produced. A readily available source of carbohydrate aids these bacteria in using ammonia. Any excess ammonia is absorbed through the wall of the rumen and metabolised in the liver. If the ammonia is absorbed too rapidly the liver cannot metabolise it, which results in free ammonia circulating in the blood. It is this ammonia and associated products which cause urea toxicity (poisoning). Thus the rate of intake of urea is the most important aspect of toxicity.

Bacteria which have used ammonia eventually die and pass out of the rumen and are digested in the small intestine like any conventional protein.

Urea is of no use to simple-stomached animals, that is, non-ruminants. Likewise, toxicity to these animals is low.

Precautions

The use of urea as a stock food calls for great care. Carelessness may result in stock losses which could well outweigh the advantages of urea. The use of urea involves some risk of stock deaths but this can be minimised if the following precautions are observed:

1. When adding to a roughage, always bring urea into a solution by adding 1½ times its weight of water (preferably warm). This facilitates uniform mixing with other feedstuff and avoids the chance of a concentration of urea in corners of troughs.

2. Ensure thorough mixing and strict observance of correct quantities.

3. Organise the feeding method to avoid—
    (*a*) Dangerously high rates of intake through the concentration of urea being too high.
    (*b*) Animals obtaining considerably more than the intended ration.

4. Avoid introducing urea to cattle that are weak, or to those that have been without feed for a period.

5. Avoid sudden changes in the composition of the ration.

6. Segregate cattle of various classes to minimise bullying.

7. Provide sufficient feeding or trough space to allow all animals to eat at once.

8. Keep stored urea labelled, and in a dry stock-proof shed.

Supplement During Drought

Urea appears to have its greatest value when fed as a supplement to low quality roughage to provide a maintenance ration. Thus, it has its greatest application during drought or under dry conditions. What are the methods of use under these circumstances?

The following methods have been attempted:

(*a*) Sprayed on conserved roughage such as low quality hay or silage.
(*b*) Sprayed on standing roughage—for example, mature grass.
(*c*) Feeding from troughs in association with molasses.
(*d*) As an additive to block licks.
(*e*) Inclusion in the drinking water.

(*a*) *Sprayed on Conserved Roughage*

In this method the aim is to distribute the urea intimately throughout the roughage whether it be hay or silage. This is best achieved by thoroughly dissolving the urea in a small volume of water and turning the roughage while spraying or using a larger volume of water and depending on the volume of water to distribute the urea. When spraying hay, it is generally desirable to pre-mix the urea with molasses (about 1 part of urea to 4 parts of molasses by weight), although with silage this does not appear to be as necessary.

Experiments with conserved roughage have been done by officers of the Department of Agriculture and Stock at the Animal Husbandry Research Farm, Rocklea.

The results illustrate the way in which urea can increase intake of a poor roughage and reduce bodyweight losses.

In one of these experiments four pens of six non-pregnant yearling Hereford heifers were fed on a basal ration of bush hay made in the Central Highlands. This hay contained 4·6 per cent. crude protein and the animals were fed as much as they wanted (that is, to appetite).

Three pens were allowed access to a lick mixture consisting of 50 lb. degelatinised bone flour, 50 lb. coarse salt, 8 oz. copper sulphate and 2 oz. cobalt chloride. Two pens of animals received 1 lb. crushed sorghum per head daily and members of one of these pens were fed 2 oz. urea plus 0·17 oz. sodium sulphate per head daily. The results are shown in Table 2.

TABLE 2

CHANGES IN BODY WEIGHT AND GROUP AVERAGE CONSUMPTION OF HAY OVER 21 WEEKS

Group	Lick	Grain	2 oz. urea 0·17 oz. sodium sulphate	Group Average Body Weight (Lb.)			Group Average Daily Intake (Lb.)	
				Initial	After 21 weeks	Change	Bush Hay	Total Dry Matter
1	Nil	Nil	Nil	461	442	−19	11·4	10·7
2	+	Nil	Nil	462	438	−24	11·7	11·3
3	+	+	Nil	476	476	0	12·6	13·0
4	+	+	+	466	545	+79	14·5	14·8

The addition of 2 oz. of urea was effective in changing a maintenance ration into a low productive ration.

In another experiment, three groups of four non-pregnant Hereford heifers were fed individually in stalls for 16 weeks. Bush hay containing 3·5 per cent. crude protein was fed. Two groups were fed 1½ lb. of molasses in addition, and one of these groups was allowed 3·6 oz. urea per head daily in addition. Table 3 shows the result of this experiment.

The addition of urea prevented the serious weight loss evident in Groups 1 and 2.

Sorghum silage of 4·9 per cent. crude protein content (dry-matter basis) was used in a third experiment using four groups each of seven non-pregnant Hereford yearling heifers. Group 1 was allowed free access to silage but received no supplement. Group 2 was fed the same amount of silage as consumed by Group 1 plus a supplement of 1·5 oz. urea plus 0·14 oz. sodium sulphate per animal daily. Group 3 was given free access to silage plus the same supplement as Group 2. The fourth group had free access to silage plus 2·5 oz. urea plus 0·18 oz. sodium sulphate per animal day. The results are summarized in Table 4.

TABLE 3

CHANGES IN BODY WEIGHT AND GROUP AVERAGE CONSUMPTION OF HAY

Group	Molasses (1½ lb.)	Urea 3·6 oz.	Group Average Body Weight (Lb.)			Group Average Daily Intake
			Initial	After 16 Weeks	Change	Bush Hay (lb.)
1	Nil	Nil	785	650	−125	10·26
2	+	Nil	762	667	− 95	9·78
3	+	+	787	778	− 9	14·24

TABLE 4

CHANGES IN BODY WEIGHTS AND GROUP AVERAGE CONSUMPTION OF SORGHUM SILAGE

Group	Sorghum Silage	Supplement	Bodyweight Group Average Changes (Lb.)			Average Feed Consumption Per Head (Lb.)	
			Initial	After 28 Weeks	Change	Silage as Fed	Dry Matter
1	To appetite	Nil	383	313	−70	18·5	5·0
2	Same quantity as Group 1 consumed	1·5 oz. urea 0·14 oz. sodium sulphate	389	357	−32	18·5	5·0
3	To appetite	As for Group 2	379	449	+70	30·0	8·2
4	To appetite	2·5 oz. urea 0·18 oz. sodium sulphate	390	507	+117	34·0	9·1

A comparison between the weight changes shows a response to the added urea but an even greater response when the animals are allowed to eat to appetite.

These experiments clearly illustrate that the addition of urea to low protein roughage (either sorghum silage or hay) markedly reduces weight losses and in some cases may even permit weight gains. This beneficial response is due to two factors; firstly by the purely supplementary value of the nitrogen and secondly by the induced increase in intake. These reductions in weight loss were always clearly evident on inspection, the supplemented animals appearing much stronger in condition. It is noted that these results were obtained on non-pregnant heifers. More experiments are necessary to determine the effect on pregnant animals.

(*b*) *Sprayed on Standing Grass*

Another method of feeding urea with a roughage is to spray it directly onto the standing grass. This method was first used successfully in South Africa and has since been tried in many parts of Australia, including Queensland. The method is normally applied only where there are good stands of mature grass at the standing hay stage and has the advantage that mechanical harvesting of grass is unnecessary. On the other hand, however, much spray mixture can be wasted on the ground if the grass cover is not sufficiently dense or in the event of rain or even heavy dew.

A 5-year study of yields of spear grass pasture near Gladstone by the C.S.I.R.O. showed that the average quarterly changes in yield were as follow:

Period	Change in Total Yield (Dry Matter in cwt./ac.)
Mid-January–Mid-April	17·14
Mid-April–Mid-July	−0·17
Mid-July–Mid-October	2·01
Mid-October–Mid-January	8·95

Thus it is evident that a system of pasture saving or deferred grazing is needed for a sufficient bulk of grass to be available for spraying during winter and spring.

A further aspect of pasture spraying which is a disadvantage under some pastoral conditions is that the animals do not bother selecting the more nutritious parts of the plants. In order to obtain its ration of urea and molasses the animal is eating stems of plants which may have little nutritive value.

Even though good responses to pasture spraying have been reported from South Africa experience in Australia indicates that response is quite variable, depending on spraying technique, pasture quality and animal behaviour. In Queensland it has not been possible to date to conduct field trials under typically dry conditions. However, producers contemplating this method should consult their appropriate local Departmental officer for advice on specific properties.

(*c*) *Feeding in Troughs*

An alternative to pasture spraying is the feeding of urea and molasses in troughs placed in the paddock. This requires less labour but involves greater risks from poisoning. It has been done experimentally and in a field trial without causing deaths but anyone attempting this method should recognise that there is quite a risk of urea toxicity if the rate of intake is high.

Work at the Animal Husbandry Farm at Rocklea showed that a mixture of 3 oz. urea to 1 lb. molasses fed in troughs was eaten at only a slow rate. Apparently at this concentration the urea had a marked effect on palatability and the animals' intake was restricted to about the desired level. Because of this it was considered that the concentration of 3 oz. urea per lb. of molasses was safer than 1 or 2 oz. urea to 1 lb. of molasses. A field trial using a mixture of 3 oz. urea to 1 lb. of molasses has been conducted. There were no deaths amongst the animals, even though the mixture was fed out only twice a week. Steers with access to urea and molasses in troughs at the rate of 3 oz. urea plus 1 lb. molasses per animal daily gained 62 lb. more than steers on a similar type of dry pasture with no supplement. This was over a period of 28 weeks. A third group, also with access to similar dry pasture, but with an allowance of 3 lb. of lucerne hay a day, fed twice-weekly, gained 98 lb. liveweight during the same period.

If attempting this method, sufficient trough space should be provided to allow all animals access to the mixture at one time. Supervision will be required in the early stages to ensure that a few animals do not monopolise the trough. This is unlikely to occur if animals are dehorned.

When introducing animals to this system, molasses only should be fed for 2 or 3 days. This should then be changed to a mixture of 1 oz. urea and 2 oz. water to 1 lb. molasses and put out daily at the rate of ½ lb. per head. Feeding should be supervised to ensure that no animal eats to excess. The concentration of urea can be gradually increased until the mixture is 3 oz. urea and 4½ oz. water to 1 lb. molasses. Note that urea is dissolved in water before mixing with molasses.

If all goes well, put out this concentration daily, that is 3 oz. urea, 4½ oz. water, 1 lb. molasses or roughly 1½ lb. of the mixture per adult animal. Finally, it may be possible to put out the mixture twice weekly.

An additional precaution for this method is to try feeding a small number of the least valuable animals before attempting feeding on a large scale.

(*d*) *As an Additive to Block Licks*

Licks are commonly used to supply animals with some essential materials which are deficient in their diet, for example, bonemeal, as a source of phosphorus. In South Africa, scientists carried out trials with a salt-molasses-urea block. With these blocks, cattle limited their intake to an economic non-toxic level. Pen trials in Queensland have shown these blocks to give a response typical of that obtained from urea presented in any other manner. Observations under field conditions are also promising.

(*e*) *Inclusion in the Drinking Water*

This form of supplementation has obvious advantages but as yet is only in the experimental stage. A method has been devised in Queensland to prevent mould growth in water containing molasses-urea but further work is needed to investigate the toxicity of such treated water. For this reason, inclusion of urea in the drinking water cannot be recommended at present.

To sum up:

- Urea is a comparatively cheap source of nitrogen for cattle feeding. Possibly, its main use is in association with low quality roughage to provide a maintenance ration.
- Because of its concentrated nature, it is comparatively cheap to transport.
- Urea is poisonous to stock. Deaths are likely if stock obtain too much, or eat a relatively small quantity quickly or under circumstances of starvation.

For details of research work quoted see—

MORRIS, J. G. (1958). *Queensland Journal of Agricultural Science*, Vol. 15. No. 4.

BEAMES, R. M. (1959). *Queensland Journal of Agricultural Science*, Vol. 16, No. 3.

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◆

This Young Wallaroo is Being Studied in Fauna Experimental Work at the Hermitage Regional Experiment Station in the Warwick District.

Modified Contour Ditch Irrigation

By **A. NAGLE,* Irrigationist.**

Some simple modification of the contour ditch method of irrigation will greatly reduce maintenance cost and reduce time required for water distribution on this layout. This modification involves the erection of small check banks approximately 33 ft. apart and at right angles to the contour lines.

The contour ditch irrigation method has been used quite successfully for irrigation of pastures on sloping land which is too steep or too uneven for border irrigation. Paspalum–white clover, and kikuyu–white clover are the main pastures irrigated. It has been described in detail in advisory leaflet No. 439.

Principles of Contour Ditch

The method has been proved suitable for irrigation of pastures on land with slopes up to 10 per cent.

The general broad principle of contour irrigation is the flowing of water to shallow ditches constructed at intervals of approximately 4 to 5 ft. vertical fall down the slope. These ditches are constructed sufficiently off the true contour line to give a slight fall in the direction of water flow.

Water is distributed from the top contour ditch to the land immediately below by means of outlets placed in the ditch bank. These outlets can be used to regulate the volume of water applied to the land below. By these means an effective control can be obtained to regulate the rate of water application to suit the pasture requirements for each irrigation.

Each contour ditch may serve as either a watering furrow or a drainage furrow. Thus when a particular bay is being watered, the furrow on its lower side will collect any excess water and redistribute it to the bay immediately below (Plate 1). Wasteful use of water is thereby eliminated.

Distribution and spread of water in its downward movement is more effective by the use of small plough furrows at intervals of 15 to 20 ft. down the slope. These "spreader" furrows are run on the true contour and collect and distribute the water evenly down the slope. The dense sward or ground cover of a well-managed pasture also acts as an effective aid in the even distribution of the water. The plan and cross-section of a contour ditch layout, shown in Plates 2 and 3 illustrate these points.

Design of Contour Ditch Layout

As contour ditch irrigation is to be used on land with slopes of from 2 to 10 per cent., there is a risk of possible loss of soil from erosion, particularly during the period of pasture establishment. The risk should be minimised by the construction of diversion banks to intercept stormwater run-off from land above the area to be irrigated.

Diversion banks are normally not necessary where the first contour ditch is situated near the crest of the slope.

Grassed waterways should be formed on each side of the irrigation area to intercept and use storm run-off water from the field. These grassed waterways can be irrigated from the ends of the contour ditches and should be regarded as an integral part of the pasture area, not as separate drainage projects.

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* After many years of valuable work with the Department, Mr. Nagle has now resigned due to having reached the age limit.

Gradient of Contour Ditches

Contour ditches should be designed with a very slight fall in the direction in which the water will be required to flow. A gradient of 0·1 per cent., or approximately 1 in. fall per chain, is generally suitable. Where only short ditch lengths are required these could be located on the true contour with no fall in either direction.

For long ditch lengths, it is advantageous to deliver water at the middle of the ditch so that a gradient or flow in two directions can be used. This avoids the necessity of increasing the ditch gradient, as would otherwise be necessary on very long ditch runs.

Steep ditch gradients require the installation of portable or permanent check structures in the ditch to raise the water level in the section from which water is being distributed. These structures add appreciably to the cost of installation. In addition, the continuous attention necessary in the setting of ditch checks as irrigation progresses is wasteful of time and labour.

Size of Contour Ditch

The size of the ditch is regulated by the water supply available. A ditch 3 ft. 6 in. wide by 6 to 8 in. deep will satisfactorily carry the discharge from a 4 in. centrifugal pump.

Plate 1

Irrigating More Than One Bay at One Operation. The contour ditch is receiving drainage water from the bay above and passing it through the bank on the left to the bay below. The electric fence line is used to control grazing on the pastures.

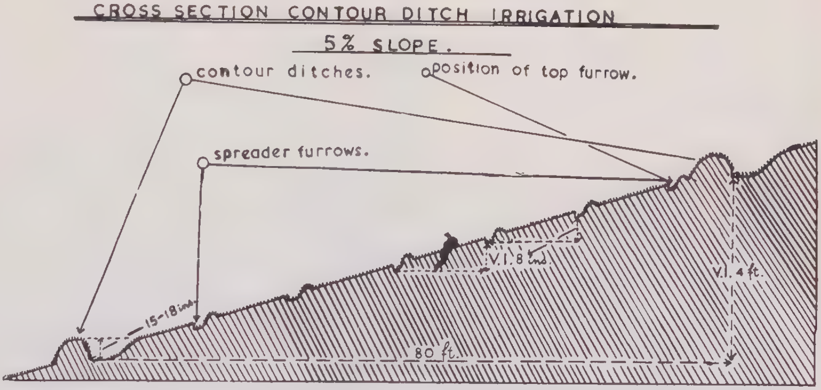

Plate 2

Cross-Section of One Contour Ditch Irrigation Bay on a 5 Per Cent. Slope. Shown in cross-section are two contour ditch watering furrows with their supporting banks and six spreader furrows. The top spreader furrow is immediately below the top bank and serves to spread the water which passes through the bank by means of outlet boxes.

Spreader Furrows

Spreader furrows are an effective means of collecting and spreading irrigation water within each bay. They are also a means of reducing velocity of flow on newly planted areas.

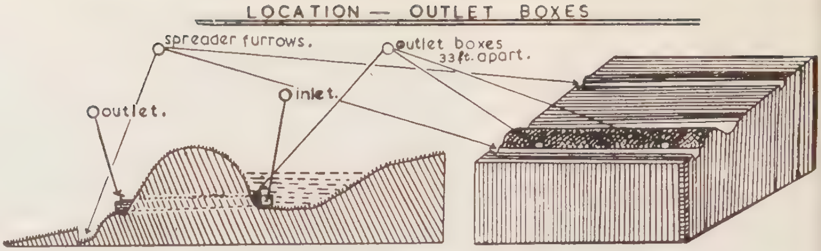

Plate 3

Two Sections Showing the Location of Outlet Boxes. Note the clean lower edge of the spreader furrow which allows water to spread evenly over the bay below.

Spreader furrows should be spaced about 15 to 20 ft. apart and should be constructed on true contour lines—that is, they should be level throughout their length. They are constructed with a single furrow plough and it is important that the furrow slice be thrown uphill, as the collected water can then flow over a clean furrow edge. In surveying the furrow lines, they should be pegged at 33 ft. intervals to ensure that there will be little deviation from the true contour.

Where slight depressions or hollows occur in a field, it is advisable to terminate the furrow short of any such depression and turn the ends of the furrow uphill to hold the water back from the depression. Continuing the furrows into a depression could easily cause overwatering and consequent waterlogging of such an area.

The topmost spreader furrow is formed immediately below the lower side of the ditch bank by throwing one furrow back against the bank. The flow of water from the outlets through the bank is intercepted by this furrow, and an even flow is thus obtained over the top of the section being irrigated (Plate 4).

Ditch Spacing

The spacing adopted between contour ditches has been based on the somewhat arbitrary figure of a 4 to 5 ft. vertical interval. This interval was chosen because it had previously been used successfully for construction of contour banks for soil erosion control on slopes of moderate gradient.

On moderate slopes this spacing has proved quite suitable for contour ditches. On the steeper slopes, however, this interval tends to make the bays too narrow and a vertical interval of up to 8 to 10 ft. may conceivably be adopted.

The dense sward of irrigated pastures acts as a most effective protection for the soil from erosion loss. It not only protects the soil from direct pounding by heavy rain but it also reduces the velocity of both storm water and irrigation water on steep slopes. Therefore, the primary concern in deciding the ultimate spacing of ditches is not so much soil conservation as efficient water distribution.

If a 5 ft. vertical interval were used on a 10 per cent. gradient, the horizontal distance between ditches would be only 50 ft. On a gradient of 2 per cent. the horizontal distance between ditches with the same vertical interval would be 250 ft.

On soils which do not readily absorb water, a horizontal distance of 50 ft. would not give effective watering unless either a small flow of water was used or the flow was continued through to two or more ditches down the slope.

On the other hand, on soils of high water intake, a horizontal spacing of 250 ft. could be excessive, resulting in wasteful use of water.

It will readily be seen, therefore, that a consideration of the soil type and its capacity to absorb water is necessary for determination of a contour ditch spacing. Further investigational work and field experience in the application of contour ditch irrigation will be required before ditch spacings can be precisely set down in relation to slope and associated soil type.

Cleaning Ditches

The application of water and, where necessary, application of fertilizer, encourages a dense stand of pasture, and in turn these dense stands have posed some problems in maintenance, due to the pasture growth, particularly that of kikuyu, obstructing the free flow of water in the ditches.

eriodic cleaning of ditches to remove obstructing rowth is necessary therefore to enable a free ow and effective distribution of the irrigation ater.

As the basic principle of this method is the onstruction of a series of contour ditches down e slope at intervals of 4 to 5 ft. vertical fall, can be appreciated that the total length of ditch an irrigated field is quite considerable. The ork of maintaining all these ditches in good rder for the conveyance of water can be time-onsuming and expensive.

Modifying Layout Increases Efficiency

A modification of the original contour ditch s described here will substantially reduce the umber of ditches required for water distribution nd therefore reduce the labour required for ditch naintenance and also the time required for super-ision of water application.

This modification involves the erection of small heck banks approximately 33 ft. apart and at right angles to the contour lines, thus confining the water flow as in border irrigation. It is then possible to reduce the number of distribution ditches, as instead of water being regulated down the slope from all of the ditches, only every third or fourth ditch is used for this purpose.

However, the remaining ditches will still serve an important function in collecting and spreading the water being applied, thus aiding in efficient distribution and coverage of water onto the field.

The water control outlets in these contour ditches should be left open at all times to redistribute the water to the area below.

Construction of Check Banks

Check banks can easily be erected in fields previously developed for contour ditch and their construction does not require expensive equipment as a single furrow plough can be used for this purpose.

The check banks should not be made by throwing the furrow slice or soil together to form a mound, as this leaves a depression or furrow on each side of the mound or bank. These furrows run in the direction of the slope and will naturally collect a big proportion of the water from heavy rain or from irrigation, causing erosion of the check banks and also in the field. Uneven wetting of the pasture area and inefficient water use will then be inevitable.

It is therefore recommended that the check banks be formed by ploughing two furrows, the second or return furrow throwing the soil in the opposite direction to the first furrow. This forms a small ditch or wide furrow with a mound of soil on either side. These mounds represent the check banks and can usually be made by one round of the plough. The small ditch is not used for drainage or

Plate 4

Spreader Furrow and Contour Ditch. The smaller spreader furrow is on the left and lower side of the large contour ditch. Both are carrying water. Portion of an outlet box can be seen in the foreground.

water distribution, its sole purpose being provision of soil for forming the check banks. This method of check bank construction is illustrated in Plate 5.

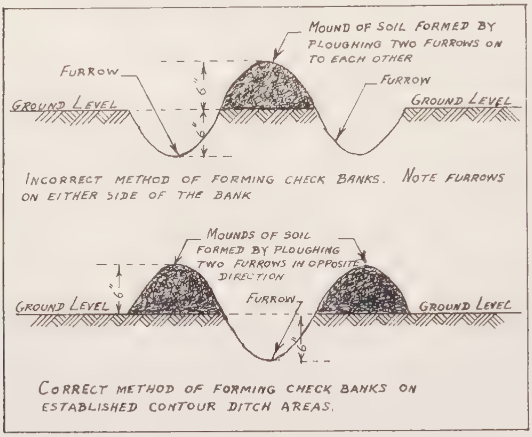
MOUND OF SOIL FORMED BY PLOUGHING TWO FURROWS ON TO EACH OTHER
FURROW
6"
6"
FURROW
GROUND LEVEL
GROUND LEVEL
INCORRECT METHOD OF FORMING CHECK BANKS. NOTE FURROWS ON EITHER SIDE OF THE BANK
MOUNDS OF SOIL FORMED BY PLOUGHING TWO FURROWS IN OPPOSITE DIRECTION
6"
GROUND LEVEL
FURROW
6"
GROUND LEVEL
CORRECT METHOD OF FORMING CHECK BANKS ON ESTABLISHED CONTOUR DITCH AREAS.

Plate 5

Check Banks for Contour Ditch Irrigation.

Note.—The low figure shows the correct method for already established areas.

Where a contour ditch irrigation system is being developed, the check banks can be constructed as for border irrigation, by dropping or moving soil into the check bank line and the loose soil compacted into a neat mound about 6 in. high by the use of the crowder. However, the large check banks necessary for controlling water flow for border irrigation on relatively flat land are not required as there is no ponding or depth of water on the sloping land on which the contour ditch system is used.

The check banks, whether formed during initial construction work or at some later time, are run approximately at right angles to the contour lines.

As the contours on sloping land are quite often irregular, the border strips of land between the check banks are then frequently irregular in shape and may be wider at one end than at the other end. This does not present any serious difficulty in watering, except where the check banks converge sharply forming a border strip wide at the top end and very narrow at the lower end.

Control of Water

Where this occurs, careful control of water is necessary to give uniform wetting of the strip irrigated. This can be obtained by progressively decreasing the flow as the water advances down the slope.

This requires fairly close supervision of irrigation of the field. If a uniform flow is used, this naturally increases the velocity of the water as the strips between check banks become narrower and excessive run-off may occur. An increased flow or rate of application can also give a lower intake of water and an insufficient water application.

Where borders converge it is therefore an advantage to have the check banks spaced 50 to 60 ft. apart at the top using two outlets for water distribution and also to terminate the check banks on converging strips 50 ft. from the bottom end. The water outlets are closed when the water reaches a point approximately opposite the bottom of the check banked area and run-off water used to irrigate the lower sections. As portions receiving less run-off from the strip above may receive surplus water from adjoining strips, there is often a compensatory effect and thus good distribution and use of water is achieved.

Still Contour Ditch

It must be emphasised, however, that the modification outlined necessitates that the layout should still be regarded as that of a contour ditch system.

The principles of this system have not altered materially and construction of contour ditches at the required intervals and of spreader furrows is still necessary in order to obtain effective coverage of water.

Check banks must be considered as complementary to the contour ditch layout, and erection of check banks without the necessary ditches and contour furrows will result in very inefficient irrigation.

Further information should be obtained from the local advisory officer when modifying or constructing contour ditch layouts.

* * *

Sown Pastures on "Rosalie Plains"

By R. G. WILSON, Adviser in Agriculture.

"Rosalie Plains," the property of Mr. S. D. C. Rushbrook, and the birthplace of Bernborough, is making further history with the championship quality of its lucerne and green panic pastures.

Consisting of some 5,000 ac. of undulating country north of Oakey, the soils on "Rosalie Plains" vary from well-drained black soil flats to brown clay and greyish-brown sandy loams. The vegetation was originally softwood scrub or ironbark gum and oak forest. The property is well situated in relation to markets as the trucking yards are almost on the doorstep, so to speak.

Encourged by his success with some pastures for cattle fattening and horse breeding purposes, Mr. Rushbrook has developed 1,200 ac. of lucerne, of which about 300 ac. are combined with the hardy, rapid-growing perennial grass, green panic.

Mr. Rushbrook has found that when a perennial grass is added to lucerne, stock readily thrive and fatten in a short time.

His green panic and lucerne have proved a great standby. There always appears to be a green pick with quick feed after every rain. Cattle are very fond of this pasture mixture, which stacks on beef and imparts plenty of bloom to them.

Rhodes grass is less palatable than green panic on this property and is rarely eaten, except when used with lucerne. Then stock eat every bit of it. For instance, from March, 1959, to November, 1960, Mr. Rushbrook gave 130 bullocks in poor condition the run of 90 ac. of lucerne and 30 ac. of Rhodes grass and turned them off fat.

Plate 1: **Cattle Fattening on Green Panic-Lucerne Pastures on "Rosalie Plains."** This photo was taken in November, 1960, following the October-November relief rains. Note the rapid regrowth.

Plate 2: **A 200 ac. Paddock of Green Panic-Lucerne Pastures on "Rosalie Plains" which Gave Valuable Feed during the Drought Period.**

The lesson to be learned from this experience is that lucerne needs grass and grass needs lucerne—for better-balanced feeding and soil management.

The oldest and still very productive lucerne stand on the property was put down 10 years ago. The most venerable green panic stand is 7 to 8 years old. Thus, without fertilizer on these soils, these pastures are true perennials and up to the present are showing no deterioration in yield such as is found with some fodder species.

Late last November, a mob of 1,200 rangy cattle brought in three lots from Victoria River Downs in the Northern Territory were given their first introduction to sown pastures. In an adjoining 200 ac. of green panic and lucerne (each sown at 2 lb. to the acre in February, 1958, on brown soil fallowed after sudan), a fat and contented lot of Cooyar cattle, brought in as stores during the winter, were glossy fat and ready to be turned off to market.

Management

In the management of his sown pastures, Mr. Rushbrook adopts the practice of taking the stock off the paddocks when excessive rain falls. This is to minimise "pugging" of the pasture area. The renovation of lucerne areas is a standard practice on the property.

Advantages

During a dry spell when annual grazing crops cannot be sown, sown pasture is a rich fodder conservation standby to fill in the gap in the feeding programme.

There is a green picking after every shower, and usually good feed within 7 to 10 days after good rain.

Sown pastures also provide green feed at least 1 month before the annual summer crops are ready to graze.

Further Development

Further sown pasture expansion is in progress on "Rosalie Plains." An area of rung ironbark and gum on a greyish brown deep sandy loam slope was cleared during the winter of 1960 at cost of £3 an acre.

The land was cultivated in the spring and sown in January, 1961, after good rains. One hundred acres were planted to green panic (2 lb.), lucerne (2 lb.), and poona cowpea (4 lb. per ac.), while 60 ac. were sown to Biloela buffel (2 lb.), lucerne (2 lb.) and poona cowpea (3 lb. per ac.).

This area, which originally carried blady grass, wire grass and other unpalatable species, is now under productive permanent pasture. These mixtures were sown through a combine drill. The grass and lucerne seed was mixed and sown through the lucerne seedbox attachment.

The cowpeas were sown through every second run of the drill, and were steadied in their flow by using leather strips hanging in the tubes.

The pasture seed was dropped on the wet soil in this case and covered by the light trail harrows.

A Word of Advice

One important item to remember is to have patience. Don't be too eager to plough out lucerne or green panic because the seed does not come up immediately like the larger seed of sudan and oats. Use lucerne as a base. If the season is suitable the green panic will come through to balance the effect of the protein-rich lucerne.

◆

USE YOUR TRACTOR SAFELY.—In your own interests and for the sake of those dependent on you, observe at all times these simple rules drawn up by the National Safety Council of Australia in conjunction with the Tractor Trade Association of Australia:

Read and act on maker's operating instructions.
Before starting, put all controls in neutral.
Never run engine in a closed building.
Stop engine to service and fuel machine.
Keep naked light or flame away from fuel.
Wear close-fitting clothes.
Keep steering and brakes in good order.
Drive at safe speeds always.
Don't snatch at loads—tractors can be overturned.
Be careful on hillsides—tractors can be rolled over.
Fit attachments correctly—avoid makeshift methods.
Don't carry "joyriders"—especially children.
Apply brakes and lower attachments before leaving.

Time Of Calving And Early Weaning Of Beef Cattle

By D. N. SUTHERLAND, Director of Cattle Husbandry.

At the Brian Pastures Reseach Station, a breeding herd of approximately 180 cows has been maintained since the station was taken over for research. The foundation herd comprised grade Hereford and Poll Hereford cows, and Poll Hereford bulls have been used continuously in the herd.

A strict pattern of seasonal mating is followed for several reasons:

Firstly, the primary function of the herd is to provide a supply of young, growing cattle for use in grazing experiments. It is desirable that the animals for this purpose be as uniform as is practicable in age, condition and type. To give uniformity of age in each calf drop, mating is confined to a 2 month period each year.

Secondly, control of time of mating, and hence of time of calving, facilitates management of the herd particularly insofar as branding, weaning and drought feeding are concerned.

The period of mating is from early January to early March each year, to give a calving period from mid-October to mid-December. This is similar to the practice followed on many commercial beef properties in the Burnett.

The calving percentage of the herd has averaged just under 80 per cent. over the past 6 years.

Cows are mated to one bull in groups of 25 or to two bulls in groups of 50 to 60.

As there was no information available on the performance of cows mated at different times of the year, it was decided several years ago to institute a trial to collect data on this aspect of production.

For this trial, three groups each comprising 22 heifers were made available. The groups are mated at the following periods:

——	Mating Date	Anticipated Commencement of Calving
Group A—Early-Mated	October 8 to December 7	July 18
Group B—Normal-Mated	January 8 to March 9	October 18
Group C—Late-Mated ..	April 8 to June 7	January 16

Observations will continue for at least 5 years on the breeding performance of these cows and on the growth rate of their calves.

The trial commenced with mating of the three groups in the 1958-59 breeding season. The main observations to date are:

- The calves dropped to the early-mated group were significantly lighter (by approximately 10 lb.) at birth than the calves of the other two groups.

- Up to 90 days of age, the calves of the late-mated and normal-mated groups had better growth rate than the calves of the early-mated group.
- From 90 to 180 days of age, the performance of the calves of the early-mated group was superior to that of calves of other groups, and by 180 days the early-mated calves were heavier than those of the other groups.
- By 270 days of age, the liveweight of calves of the early-mated group was approximately 100 lb. greater than that of the calves of the other groups in the first year's calf drop.
- There is as yet no evidence of difference in fertility between groups.

The superior performance of the calves of the early-mated group is due to the fact that milk production of dams and growth rate of calves declines sharply at the end of summer or early autumn because of the declining feed value of pastures. At this time, calves of the late-mated group are approximately 3 months of age.

Observations have also been made on the effect of time of weaning on the growth rate of calves. In the main breeding herd it has been the practice to wean calves in August at 9 months of age. This system imposes a heavy strain on the cow which calves each year; through the winter and spring months when feed is at its poorest she is nursing a calf and carrying another calf in the womb.

In several years, groups of calves have been weaned in May and their subsequent growth rate compared with that of calves which remain on the cows until August. The early weaned calves lose some weight between May and August; whereas those remaining on the cows generally maintain weight or make slight gains. However, the difference existing between the groups at August has in each year been eliminated subsequently by compensatory gains made by the early-weaned calves.

It has been concluded that early weaning has no permanent ill effects on the calf. In consequence the practice is now being adopted of weaning calves at "Brian Pastures" at 6 months of age in May instead of at 9 months of age in August.

Interpreting Overseas Tractor Test Reports

The Australian tractor testing scheme is a voluntary one: manufacturers please themselves whether or not they take advantage of it. Some of those who have not yet done so prefer to rely on overseas tests, even though the model marketed in Australia may differ from its overseas counterpart in various ways especially in wheel equipment.

The Australian Tractor Testing Committee emphasises that, while the test procedures may be much alike in Australia and overseas, there is a basic difference in objective. The Australian test is essentially an independent acceptance test on a typical tractor; overseas tests on the other hand are usually conducted so as to show the performance of one of the top tractors off the line.

In a statement issued recently, the Committee says:

"In overseas tests there is nothing to prevent the maker from selecting for test an engine from the top of the range of performance on factory test, and from giving it special preparation and extensive running-in. Such an engine might be expected to give a power output greater than for an average of the model by 5 per cent. or more.

"In drawbar tests excessive ballast is allowed—considerably more than would be recommended for field use—giving unrealistic values for maximum drawbar pull.

"The Australian test calls for a typical tractor randomly chosen from stock or production, and limits added ballast to that recommended by the maker for normal field use.

"Because of these and other differences, comparisons based on overseas tests are difficult to reconcile, and lead to misunderstanding.

"Though there is some hope that these differences may be eliminated by the adoption of a strictly observed standard International Test Code, recent and current test reports from overseas contain these differences that need explaining."

These Farmers Co-operated To Conserve Soil

By J. ROSSER, Soil Conservationist, and
K. B. ANDERSSEN, Adviser in Agriculture.

This article tells the story of teamwork which brought the benefits of modern soil conservation planning to the farmers of Gurgeena.

A small isolated tableland in the heart of the cattle country is not the place where one would expect to learn a lesson in soil conservation. Consequently, visitors to the Gurgeena Tableland in the Central Burnett district of south-east Queensland never fail to be surprised by the up-to-date layout of the farms with their network of contour banks and waterways.

The Gurgeena Plateau lies between Gayndah and Mundubbera. Fifteen hundred feet above sea level, it is an area of red soil some 3,000 acres in extent, small but extremely fertile. It was originally settled as a dairying area with holdings of 140 to 180 acres. A change to cash cropping began about 1950 and today the area is devoted almost entirely to the cultivation of maize and peanuts and to a lesser extent, the winter cereals.

Erosion Follows Cultivation

The change to intensive cultivation brought with it a problem of soil erosion. When dairying was the main occupation the area was relatively free from wash. As the switch to cash cropping proceeded, the land lost its mantle of protective grass and became exposed to erosion by rainfall. Run-off from the summer storms carried soil into the drainage lines, and gullies began to appear in the cultivations.

Plate 1

Newly Built contour banks on Mr. D. Patterson's farm, Gurgeena Plateau.

The Gurgeena farmers profited by the experience in other red soil areas where it was found that major erosion losses occurred if cultivation was allowed to proceed for too many years without contouring. The Gurgeena farmers decided to take steps to prevent erosion before it became serious. Contour banks were being used to reclaim badly eroded cultivations in other districts. Why not establish contour banks before the erosion losses assumed serious proportions and while the precious topsoil was still in place?

But how to go about it? There were problems. With practically the whole of the plateau under the plough, run-off water was running from one farm to the next. Before contour banks could be put in on some farms, arrangements would have to be made with neighbours to receive the run-off from the banks. There was a Local Authority road running through the middle of the plateau and it also had to be considered.

They decided to hold a meeting. Representatives of the local Shire Council at Mundubbera were invited to attend together with the agricultural adviser from Gayndah and soil conservation officers from the Agriculture and Stock Department at Kingaroy. There was a full roll-up of local farmers.

Group Committee Formed

At this first meeting on March 17, 1959, a Soil Conservation Group Committee was formed with Mr. C. Stafford as Secretary; the executive members were Messrs. C. Christiansen, D. Meredith and R. Patterson. The problem was discussed fully and it became clear that a catchment plan for the whole plateau was needed.

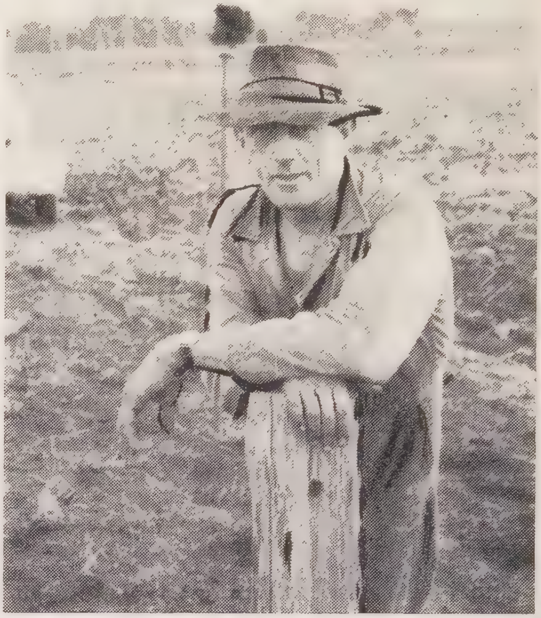

Plate 2

Mr. C. Stafford, Secretary of the Gurgeena Soil Conservation Group Committee.

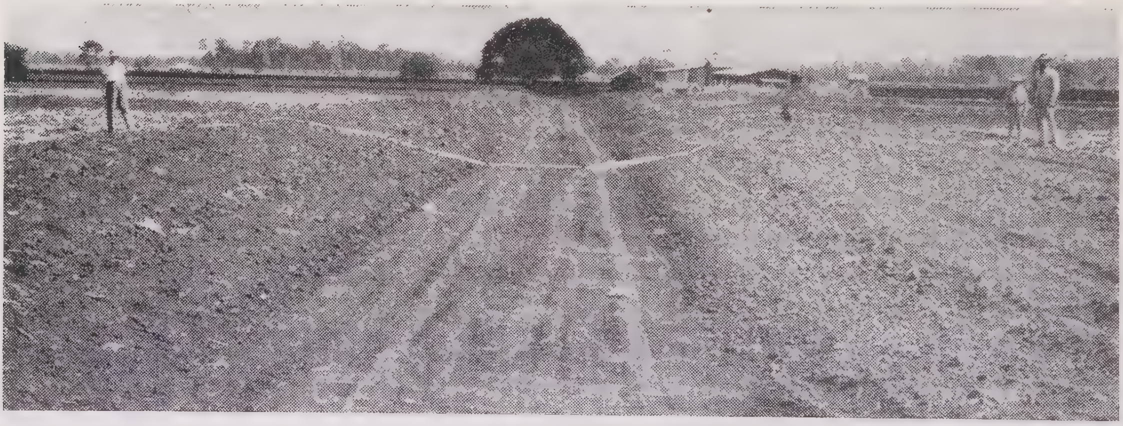

Plate 3

Looking down a newly-built waterway on Mr. C. Christiansen's farm. Note the sub-surface construction and spread banks.

he soil conservation officers undertook to repare a tentative plan which would be dis-ussed by all at a further meeting.

A few months later a second meeting was lled by the Group Committee. Shire Council presentatives were again invited to attend. The ntative plan prepared by the Agriculture and ock Department officers was now ready. The rmers and shire councillors examined it and spected the sites of proposed waterways and ad crossings. Certain alterations were decided n and incorporated in the original plan. The rmers now had a plan which had taken into nsideration the wishes of all concerned. Some give and take” was necessary in order that each farm plan might have a layout which ensured convenient access to each property. In general the waterways were designed so that they followed the natural drainage of the land. In all cases of disagreement, the principle of leading the water to natural points of disposal was the deciding factor.

The possibility of implementing the plan under Section 47 of the Local Government Acts was discussed, but the Gurgeena farmers decided that in their case, implementing the work on an individual farm basis would work best, with each farmer paying for the work that benefited him directly. In most cases this meant each farmer paying for the work on his own property.

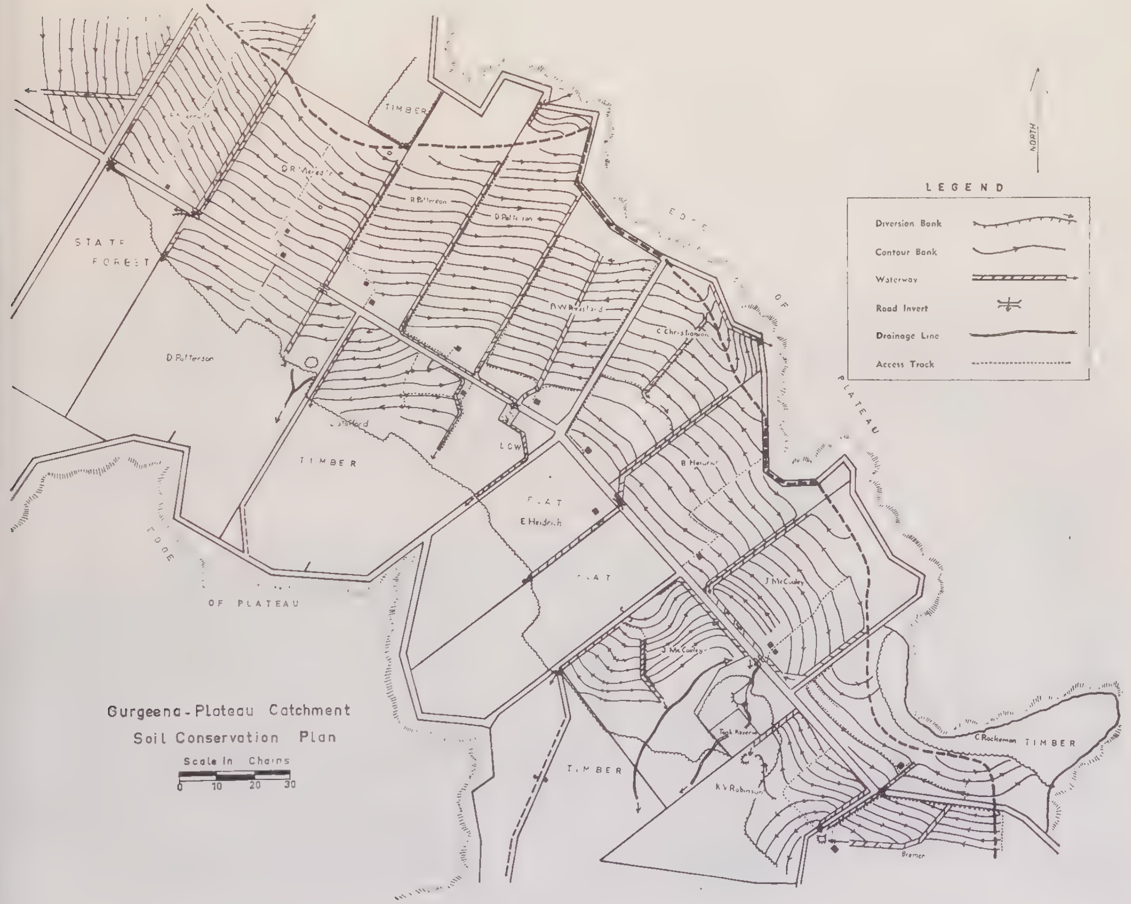
Gurgeena-Plateau Catchment
Soil Conservation Plan
Scale in Chains
0
10
20
30
LEGEND
Diversion Bank
Contour Bank
Waterway
Road Invert
Drainage Line
Access Track
NORTH
STATE FOREST
TIMBER
EDGE OF PLATEAU
EDGE OF PLATEAU
FLAT
D.R. Aered'r
R. Patterson
D. Patterson
D. Patterson
R.W. Brassford
C. Christianson
L.C.W.
E. Heidrich
B. Heiner
J. McCauley
J. McCauley
K.V. Robinson
C. Rockeman
Bremer

Plate 4

The Gurgeena Plateau Soil Conservation Plan.

The Mundubbera Shire Council agreed to build inverts across the Shire Road to link up the waterways.

Construction Programmes

The decision of the Gurgeena farmers to foster individual action in conformity with a master plan has cut red tape and enabled speedy progress to be made with the scheme.

The main construction work started after harvest of the 1959 summer crop. Before the end of November, 1960, the complete waterway network had been built, together with a substantial proportion (60 per cent.) of the required contour banks. Only 18 months had elapsed since the first meeting. The works had been planned, 9 miles of waterway had been built on 13 different farms by 13 different farmers. In addition contour banks had been built on 1,044 acres on 11 different farms. All this work dovetailed neatly to form a co-ordinated drainage pattern. The only compulsion was the verbal undertaking made by each farmer that he would work in accordance with the agreed plan. The Mundubbera Shire Council kept its part of th bargain and built the necessary road inverts.

Fruits of Co-operative Action

Difficulties are normally associated with th establishment of waterways in intensively farme areas with poorly defined drainage lines. Th Gurgeena farmers have shown that a genuin spirit of co-operation between neighbours is th quickest way to overcome them.

They realise that contour banking will n solve all their erosion problems. They expe to have to return partially to grassland farmin but it will be pasture in rotation with cash crop not all pasture as in the early days. The contou banks will help them to retain a high proportio of their land in the more remunerative cas crops which have brought increased prosperit to the district.

The Gurgeena Soil Conservation Grou Committee is to be commended for its leadershi and the Gurgeena farmers congratulated on the foresight in taking early measures to contr erosion. Their soil is rich and fertile and the intend to keep it that way.

Mr. Bob Stranger, Veterinary Officer, Goes over the Pleuro Campaign Itinerary with Mr. B. E. Buchanan, "Country Life" reporter, a Few Minutes before the Vanguard of the Campaign Personnel left Brisbane on Its Extensive Journey Covering the Cattle Areas of Queensland.

ulling By Fleece Weight, sing Temporary Ear Tags

K. E. WELLS, Husbandry Officer, Sheep Husbandry Branch.

This article shows why it pays to weigh fleeces in a commercial flock, and gives a ractical method of fleece identification by the use of temporary ear tags.

If, by virtue of good annual lamb marking rcentages, you have surplus young sheep for ck replacements each year, you will require sell some of these to keep your flock numbers nstant. Naturally you will want to keep the st wool producers yourself. By selecting these h the aid of fleece weighing you will obtain greatest improvement in average cut per ad in the sheep you retain. This will be e for both ewes and wethers in your present ck. A small fraction of the above-average ece weight gained in the ewes will be inherited the next sheep generation.

Culling in commercial flocks is done almost irely by hand and eye appraisal alone. Many ziers are aware, however, that efficiency of ection for clean fleece weight can be about ubled by using greasy fleece weight as the sis of their selection. This is true even though ssing may be in the hands of a professional eep classer. Fleece weight is the factor with greatest influence on financial returns per ad.

dividual Identification

Graziers are frequently deterred from fleece ighing because of the necessity for individual ntification of their sheep. Unless you are ng coloured ear tags instead of age marks, trouble and expense of permanent numbered ear tags seems unwarranted for sheep that will require individual identification only once in their lives. To overcome this difficulty, a method has been evolved in which a limited number of temporary numbered ear tags is used to identify sheep during and shortly after shearing. The method has proved itself in practice.

The Temporary Ear Tags

The temporary ear tags resemble alligator clips about one-and-a-half inches long on which numbers are engraved (see Plate 4). They are currently available at 13s. 6d. a dozen from Agricultural Services, Pendle Hill, New South Wales.

The Principle of the Method

The method is based on the fact that if you take a completely random and large enough sample of a mob of sheep, and weigh their fleeces, the results will give a reliable guide to the average performance of the whole mob. From the results of your random sample you can determine a culling line for the mob.

The culling line is the greasy fleece weight below which your required percentage of culls will be expected to fall.

Accuracy in determining the culling line depends largely on the size of your random sample, which should contain at least 400 sheep.

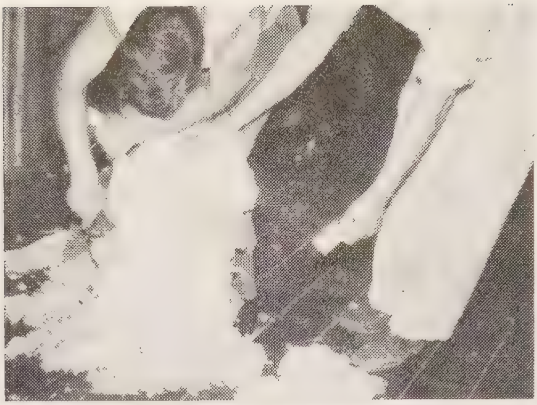

Plate 1

Ear Tagging on the Board. After the wool is removed from around the left ear, a temporary ear tag is clipped on to the back of the ear. At the same time a fleece weight card bearing the number of the ear tag is placed on the belly wool.

Plate 2

The Fleece is Weighed. The fleece and belly wool are placed on the scales and the total greasy fleece weight recorded on the fleece weight card.

In a six stand shed, roughly 400 sheep will be shorn in two runs. This is a convenient number for a sample mob. Approximately 500 temporary ear tags are sufficient for a six stand shed and a sample mob of 400 sheep. In a shed where more than 400-500 sheep are shorn in one run, there would have to be enough tags to accommodate a run. It is also necessary have a few dozen tags in excess of the numb in the sample mob to fill in a run if need be.

Fixing the Culling Line

Shear and record the greasy fleece weigh of all the sheep in the sample mob. It is th a simple matter to calculate the fleece weig below which a sheep qualifies for culling.

Suppose you require 1,500 replacements fro a total mob of 2,000 two-tooths. Your culli rate will be 25 per cent. Suppose also th you have already culled 60 of these by ha and eye appraisal. You therefore have 1,9 sheep eligible for fleece weighing. Since t total number of culls is to be 500, 440 of the sheep will be culls—

$$\frac{440 \times 100}{1940} = 22{\cdot}7 \text{ per cent.}$$

If your sample mob from the available 1,9 is going to be 400 sheep, it follows that 22·7 p cent. of the sample mob will also be culls = sheep. Arrange the fleece weights in ascendi order. The fleece weight of the sheep 91 fr the sheep with the lowest fleece weight is yo culling line. It may be 7·1 lb. Then for t rest of the mob, you will cull all sheep wh greasy fleece weights are 7·1 lb. or less, in or to finish with approximately 440 culls.

The Method in Practice

Prior to shearing, class the two-tooths by e taking out only those sheep with obvious fau of conformation and type, and with serious wo faults. You may consider working out a list the most commercially important disqualifyi faults for your district and your particular ty of sheep. Some which you might consider are

Undershot or overshot jaws
Deformities of body or limbs
Turkey hocks
Excessive wrinkles
Black or brown wool fibres or patches
Wool blindness or muffled face
Faulty backline cover

Off-type fleeces, for example:

excessively fine or strong;
excessively harsh;
preponderance of hair fibres;
excessive colour and condition.

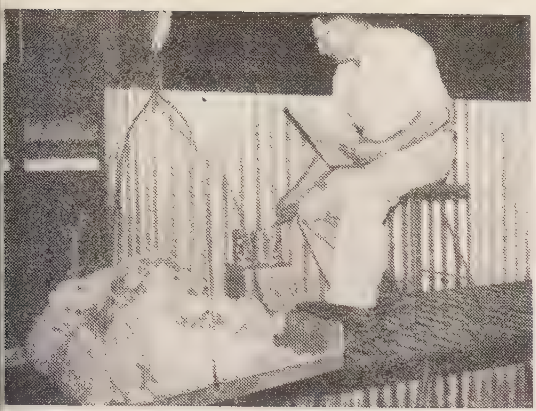

Plate 3

The Fleece Weight Card is Filed. According to the greasy fleece weight and the pre-determined culling line, the fleece weight card goes into either "Cull" or "Flock" tin.

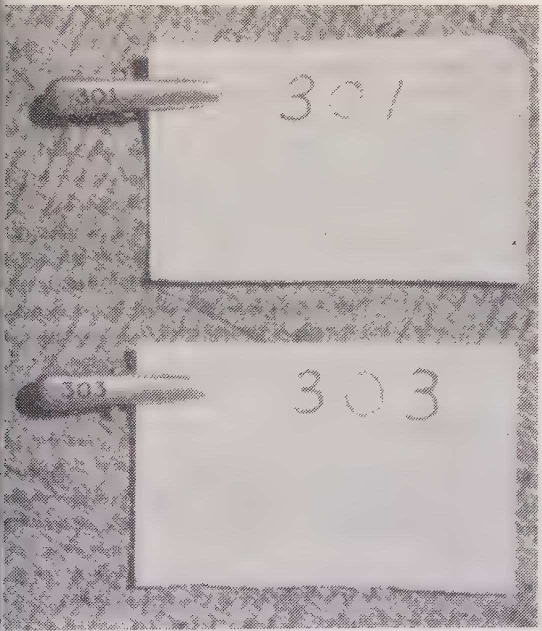

Plate 4

Ear Tags and Fleece Weight Cards Ready to Use. This avoids pencilling on the board. The operator simply clips the tag on to the ear and places the card on the belly wool.

Plate 5

Ear Tags are Checked and Removed. At the end of a run, the ear tag numbers are checked against the list of culls.

Plate 6

A Cull is Branded.

It is essential to confine this visual culling to commercially important faults, so that as much culling as possible may be done by fleece weight. The fewer sheep you cull for serious faults by hand and eye appraisal, the greater will be the possible improvement in average cut per head from your fleece weighing.

The Random Sample

One way to get a random sample is through the drafting race. If your sample mob is to be 400, and the total number of sheep in the mob in question is 2,000, then draft off every fifth sheep up the race.

When to Shear the Random Sample

Shear the sample mob before the rest of the mob under test. It is a good idea to finish shearing the sample mob just before the end of the last run of the day. In this way you will need only a few more tags to finish the run, and more important, you then have plenty of time to calculate your culling line, check and remove ear tags, brand the culls, and prepare tags for the next day's shearing. This is the busiest period.

At Shearing

As a sheep is being shorn, and after the wool is removed from around the left ear, a numbered ear tag is clipped on to the back of the ear, and about half way between its tip and base. At the same time a fleece weight card, bearing the number of the ear tag is placed on the belly wool. At the completion of the shearing of each sheep, belly wool and fleece wool are put on the fleece weighing scales hanging near the rolling table.

The total greasy fleece weight is written on the card, which is then filed in either "cull" or "flock" tin (this assumes that the sample group has been shorn and the culling line determined; during the shearing of the sample group the cards are kept together, and the culling line worked out when the sample group is finished).

Belly wool is afterwards tossed into a bale near the scales, and the fleece is thrown on to the rolling table.

Pencilling on the Board

It has been found unsatisfactory to transcribe ear tag numbers on to fleece weight cards on the board. It is better to have each ear tag clipped beforehand on to a card on which the corresponding ear tag number has been written. By doing it this way, the person ear-tagging is not concerned with any numbers or pencilling—he simply clips the ear tag on to the ear and places the card with the belly wool.

Keep tags plus cards in a box or tin in a convenient place on the board.

Checking and Removing Ear Tags

After each run, once the sample runs have bee completed, one person removes the ear tags ar calls their numbers. A second person checks th list of cull ear tag numbers, calling "cull" o "flock" as the case may be. Culls are brande To avoid mistakes and to save time, arrange cu ear tag numbers in numerical order under group say 1–99, 100–199, 200–299, and so on.

It is convenient to check ear tags in your clas ing, branding or jetting race, somewhere han to the counting out pens.

Once the ear tags are removed they are avai able for use again on the board.

To Obtain the Precise Culling Percentage

By following the method as outlined, you w not, in all probability, obtain exactly the require number of culls. By applying elementary stati tical techniques to the results from the samp mob, and by increasing the size of the samp mob, possible discrepancies will be reduce However, if you require a precise number of cull there is a simpler way to do it.

Suppose for example, you have determined th culling line at 7·1 lb. Cull and brand all she whose greasy fleece weights are 6·9 lb. or le Class in all sheep whose greasy fleece weights a 7·3 lb. or more. Cull but raddle distinctive according to weights the sheep whose grea fleece weights are 7·0, 7/1, or 7·2 lb. At the e of the fleece weighing you may find by so doi that, whereas you require 440 culls, you ha 335 branded. The other 105 can be obtain first from the 7·0 lb. raddled group, then t 7·1 lb. raddled group, and so on.

Extra Labour Required

One man works at the scales. His job is record fleece weights, classify each fleece weig card, and arrange the culling list at the end each run.

One man is required on the board to do th tagging.

A third man may be necessary and is advisab for the first time. This depends on the c operation from the picker-up, which is usuall given willingly. If a third man is used he will p the bellies away, and throw the fleeces on to th rolling table.

At the end of each run, the two or three men nsfer to the checking race, where one calls numbers and removes tags, another checks the l list and brands the culls, or the third man nds the culls.

nancial Returns

Several factors will have a bearing on gross urns from classing your young sheep by this thod. They include:—

The culling level.—This determines, within a ticular mob, the increase in average greasy ce weight of the classed-in sheep over the rage greasy fleece weight of the original mob.

The market value of the wool.

The number of times the sheep will be shorn in before their disposal.

The size of the classed flock.

The average annual death rate.

In a flock recently classed by fleece weighing conjunction with visual appraisal, the improvent in average cut per head was 0·4 lb. (6·4 oz.) greasy wool. The culling level was 20 per cent. approximately 1,800 two-tooth ewes. Station ords showed a 5 per cent. average annual death e. Assuming there will be five more shearings ore the disposal of the classed-in sheep, and ing 48 pence per lb. as the average value of the ol, the expected gross return on the classing s estimated to be £196.

To this can be added an amount for the fleece ight advantage passed on by the ewes to the t generation. This amount is relatively small, and difficult to estimate. However, the gain in fleece weight it represents is permanent in your flock.

The costs involved in fleece weighing include—

The value of extra labour.

The purchase of ear tags.

The cost of fleece weight cards (1,000 cards $2\frac{1}{2}$ x 2 in. are about 25s.; both sides of each card can be used).

The ear tags probably represent the largest single item of the costs. Their cost in succeeding years, however, is nothing, beyond perhaps a few replacements from time to time.

The Fleece Weighing Scales

The Department of Agriculture and Stock uses a clock face spring scale weighing by tenths of a lb. up to 30 lb. The pan is 3 ft. by 2 ft. 6 in. and is suspended by two or three struts, making for easy loading and unloading of fleeces (see Plates 3 and 4).

Fleece weighing scales may be purchase or may usually be obtained on loan from the Sheep Husbandry Branch, Department of Agriculture and Stock, William Street, Brisbane, or from your district Sheep and Wool Adviser or Sheep Husbandry Officer.

Acknowledgements

The author is grateful to Mr. J. te Kloot, "Marmboo", Longreach, who made facilities available for the original work on the method, and for the photographs.

* * *

Labels on Stock Food

An important provision of the Agricultural ndards Act is that a clearly printed label must attached to each package of stock food.

On each of these labels is a list of the materials composition. This list includes, besides the ıal basic stock food ingredients, the names of y additive materials such as vitamins, trace ments, antibiotics and medicants included in preparation.

The guaranteed analysis is another important m which appears on stock food labels. This is a list of the nutrients which are available in the preparation.

This guaranteed analysis is given particular attention by departmental officers who regularly sample and analyse the stock foods being offered for sale.

This work is undertaken to ensure that stock foods conform with their registered compositions and the knowledge that it is being carried out induces manufacturers to maintain their products a little above the registered analyses.

Plate 1: **In this General View, the Feed Troughs Are Seen Along the Fence Line at the Right Hand Side and the Shade for the Water Trough Can Be Seen in the Division Fence between the Two Large Shades.**

A Feedlot in Central Queensland

By K. F. HOWARD, Formerly Senior Adviser in Cattle Husband

The biggest known grain feedlot in Australia at the time of writing was at "Arcturus Downs", Springsure, which was fattening 640 steers at once on sorghum grain grown on the property.

"Arcturus Downs" is the property of Ryan Estates and is managed by Mr. D. O'Donohoe. After preliminary trials in 1959 and early 1960, the management decided to develop the feedlot enterprise.

The Cattle Husbandry Branch of the Department has co-operated in the venture, which to a big extent is experimental in nature.

It is not held for a moment that all the answers have been found but there are many points which could be of use to others.

The information in this article is intend mainly to assist those who may contemplate t feedlot method of fattening.

Interested people are advised to weigh ca fully the pros and cons before investing la amounts of capital on such an enterprise.

PROPERTY SITUATION

"Arcturus Downs" consists mainly of op black soil downs which are very suited to t growing of summer crops. Of the crops gro in the area, grain sorghum is by far the mo common.

The native grass cover on "Arcturus" is erior. Blue grasses grew originally but ause of repeated grazing by sheep, grasses h as white spear, feather top and Yabila have ome dominant. The carrying capacity is rated only about 1 beast to 15 acres—in spite of high fertility and moisture retaining capacity the soil.

When cultivated, this land is capable of pro- cing high yields of summer growing crops.

GRAIN PROBLEM

High costs of marketing sorghum grain plus improved beef market prompted the manage- nt to establish a feedlot. In this way the in could be marketed indirectly—as fat beef.

Costs of marketing the sorghum grain after rvesting on this property until arrival at adstone are about £8 5s. a ton.

When sorghum is grossing £16 10s. a ton, this ves only £8 5s., out of which must be taken wing charges.

As an alternative, young steers fattened mainly on grain and grossing £11 per 100 lb. carcass weight in Cannon Hill can be marketed for 24s. a 100lb. This cost includes road and rail freight and all selling charges. These prices and costs relate to July, 1960.

FATTENING PROCEDURE

So far the feedlot has fattened young cattle, most of which have been brought into the feedlot in store condition. Ages have varied mainly from 10 to 14 months on entry. Liveweights on entry have ranged from 400 to 600 lb. Such cattle are being fattened in from 90 to 120 days with an average of 105 days per steer.

Weight gains have varied. The steers usually show a slow rate of gain during the first 28 days. (Actually the gain over this first period can appear to be greater than it really is. If steers are empty on the first weighing, the first gain will be largely due to "fill" as on each weighing after the initial weighing, cattle are always full, being weighed direct from the feedlot.)

Plate 2
The Line-Up at the Feed Trough.

If the cattle are "full" at the first weighing, it appears that the average overall gain is at the rate of about 2·3 lb. per day.

In 105 days, this gives a total liveweight gain of 241 lb. or approximately 145 lb. of carcass beef.

A typical gain would be as follows:

	lb.
First 4 weeks	24
Second 4 weeks	74
Third 4 weeks	82
Final 3 weeks	61
Total for 105 days	241

A steer weighing 500 lb. on entry would go out weighing 741 lb. with an estimated dressed weight of 393 lb. Such a steer has a calculated dressing percentage of 53 based on a "full" liveweight.

GAIN IN £ s. d.

A steer weighing 500 lb. liveweight has a store value of about £25. With beef at £11 per 100 lb. Cannon Hill, these fats of 393 lb. dressed weight would bring £43 4s. Selling charges per steer amount to approximately £4 14s. which gives a net return of £38 10s. This figure less the original store value gives a difference of £13 10s.

The big question is, of course, how much does it cost to add the value of £13 10s. and what capital is tied up in buildings, equipment and running costs?

FEEDS

As grain sorghum can be produced efficiently, it forms the basis of the ration. Sudan hay can be produced cheaply but a short hay-making season causes a bottleneck. Alternatives are to buy hay when it is cheap or to make silage.

As roughage supply is limited, close to minimum requirements are fed. This means a 600 lb. steer would receive only about 4·2 lb. per day of Sudan grass hay. Grain feeding is heavy so that the same steer would account for about 20 lb. of grain a day. In addition, each steer received ·16 lb. of urea a day and ·06 lb. of ground limestone.

Under present conditions, actual feed intake is difficult to measure. The method is to weigh a 4 gal. drum and then count the number of drums of grain that are poured into the hamm mill. Approximately 2 per cent. of grain is lo in the hammermilling process. Apart from th a certain amount is spilled when the feed is pou ing into the feed trough. The steers also spill certain amount of feed in the chewing proce It is possible that a baffle board on the trou would overcome these losses. In any case t grain consumption is heavy but the price of lan ing the cheapest hay suitable at £14 a ton the property is double the cost per lb. producing and storing grain at £7 per ton.

CAPITAL COSTS OF FEEDLOT ENTERPRISE

(In addition to production and storage of fee

Fixed Costs:

Posts (Yard posts at 8s. per post erected)	
Wire	
Nine gates at £10	
Four shades at £100 each	4
Water facilities	8
Feed trough (800 ft. at 25s. per foot)	1,0
Corduroy at feed trough (15s. per ft.—800 ft.)	6
Portion of horseyards and crush	3
Scales	5
Trough feeder	1,
Old tractor	[illegible]
Hammer mill	[illegible]
Total outlay on yards and feeding equipment	£5,

Annual Costs of Yards and Equipment:

Depreciation on feeding equipment and yards	5
Road grading	
Interest on capital	3
	£8

COSTS OF FEEDING OUT

The costs of feeding out concern fuel for tractor used to haul the machine which delive the feed to the troughs and also labour and ma agement costs. These are based on an annu operational period of 33 weeks during whi 1,300 head of stock are fattened.

Fuel for the tractor costs 6s. an hour for hours daily which is £1 16s. daily or £416 f the period.

Labour costs for one man and one youth are £30 weekly = £990.

Management costs are 5 hours weekly at £1 an hour = £5 weekly = £165 per year.

Therefore total annual cost of feeding (other than feed cost)—

		£
Fixed	=	874
Fuel	=	416
Labour	=	990
Management	=	165
Total		£2,445

Assume that 1,300 head of cattle are fattened in 33 weeks:

$$\text{Therefore, cost per steer} = \frac{£2{,}445}{1{,}300}$$

= £1 17s. 7d. per steer

Interest on capital outlay on cattle has not been considered.

FEEDING AND FEED COSTS

Suppose a steer comes in weighing 500 lb. and goes out weighing 741 lb.

His total consumption of feed in 105 days is approximately:

Sorghum grain	1,904 lb.
Sudan grass hay	479 lb.
Urea	17 lb.
Ground limestone	6.3 lb.
Oxytetracycline mixture ("Terramycin")	4 oz.

At the time of writing this article the method of fattening is to bring steers onto full feed over a period of 14 days. This is done in two small "breaking-in" yards. On the first day, cattle are given about 12 lb. of ground hay and 3 lb. of cracked grain. The grain is increased daily and the hay decreased until on the fifteenth day the steer will be eating about 3½lb. hay and 15 lb. grain.

FEED CONSUMPTION PER DAY

—	Grain	Hay
First 14 days	10	7
Second 14 days	18	3½
Second 28 days	19	4
Third 28 days	20	4½
Next 21 days	20	4½

In addition to these basic components; urea is fed at the rate of ·16 lb. per head per day and ground limestone at ·06 lb. per day. Mr. O'Donohoe has observed very promising results with the feeding of ¼ oz. of the oxytetracycline mixture per day for the first 14 days. Scouring had occurred in the first two weeks of feeding prior to the use of this antibiotic. Landed costs allowed for feeds are:—

Grain £7 per ton (produced and stored).
Sudan grass hay £5 per ton (produced and stacked).
Urea . . . . . . = £60 per ton.
Ground limestone . . = £20 per ton.
Oxytetracycline mixture = 2s. 3d. per lb.

Feed Cost per Animal

		£	s.	d.
1,904 lb. grain	=	5	19	0
479 lb. hay	=	1	1	0
17 lb. urea	=		9	3
6.3 lb. limestone . .	=		1	2
4 oz. antibiotic . .	=			7
		£7	11	0

To this figure must be added capital costs plus costs of feed preparation and general running expenses.

COST OF GRAIN SORGHUM

Since grain forms the basis of the feedlot operations, the following particulars are given of how the cost of £7 per ton was obtained:

	£	s.	d.
Growing	3	15	0
Harvesting	1	1	10
Cartage (paddock to silo) . .		10	7
Storage	1	5	7
	£6	13	0

1. Cost of growing includes cultivation and seed cost = £2 10s. per acre.

1½ acres per ton of grain = £3 15s. per ton.

2. *Harvesting—*

The 42 h.p. wheeled tractor used costs 30s. an hour of operation on this property.

Headers—

Two headers are used for harvesting grain from 1,400 acres and cost £1,000 cash each.

Annual depreciation and interest charges on each header are £160. Each header handles 700 acres at the rate of 3 acres an hour. This amounts to 233 hours. Depreciation and interest charges are therefore 13s. 9d. an hour.

Total harvesting costs an hour then are:

	£	s.	d.
Tractor and driver	1	10	0
Plus header		13	9
	£2	3	9

Since two tons are harvested from 3 acres in 1 hour, the cost of harvesting 1 ton is the cost of half an hour's operation, which is £1 1s. 10d.

3. Cost of Cartage:

Truck with bulk bin cost = £2,600
Milage per year .. = 8,000
Allow 16 m.p.h. whilst on job .. .. .. = 500 hours per year.

	£
Depreciation at 10 per cent.	260
Registration ..	30
Insurance ..	30
Maintenance and Tyres and Tubes ..	100
Interest at 6 per cent. ..	156

	£	s.	d.
£576 = Per hour	1	3	0
Petrol at 6 miles per gallon .. .. = 2½ gal./hour ..		12	0
Driver		7	6
Total Cost per Hour ..	£2	2	6
1 Truck load of 6 tons in 1½ hours costs	£3	3	9
Cartage per ton		10	7

4. Cost of Storage:

Silos:
One 3,000 bushel silo erected costs .. .. = £600 { £300 cost; £300 erection and including cost of silo auger.

Depreciation at 10 per cent. and interest at 6 per cent. = £96.
Therefore annual cost = £96 for storing 75 tons.
One ton storage = £1 5s. 7d.

The stated costs of growing, harvesting, carting and storage amount to £6 13s. a ton but to be conservative, the total cost of producing and storing grain is given at £7 a ton.

Total overall cost per steer is—

	£	s.
Feed	7	11
Fixed plus variable running costs ..	1	17
	£9	8

In the example previously mentioned, stee gained £13 10s. in actual value in the feedlot. I such cases, these steers would have yielded a n profit of £4 1s. 5d. a head.

Naturally, greater profit could be made if stee were bought cheaply and sold at about £13 pe 100 lb. This type of situation can operate whe grazing of native pasture is scarce.

DESCRIPTION AND COST

Yard and Trough Details

Yard space is something that will var according to climate, drainage, size of cattle an whether cattle are horned.

There are four main yards at "Arcturu Downs". Two small yards are used for th purpose of getting the cattle accustomed to th ration before they are moved into one of the fou main yards.

The following are the particulars of yards:

Yards 1 *and* 2: Yards 1 and 2 adjoin as yards 3 and 4.

The dimensions of each are 200 ft. by 60 ft. 12,000 sq. ft.

The yard fence is comprised of a four stran barbwire fence, 6 ft. 6 in. posts being plac 2 ft. 6 in. in the ground. The top wire is 46 i above ground level. Posts are 4 in. in diamet at the small end. Panels are 12 ft. long. Corn posts are 6 in. in diameter at the small end an 3 ft. in the ground.

Shade shelters are 60 by 30 ft. with the shad material 10 ft. from ground level in order to allo ample air circulation.

The feed trough runs the full length of the tw yards (400 ft.).

The feed trough is outside the yard itself s that steers put their heads under a 4 in. by 2 in rail to feed. The rail runs along the top of th posts. There is also a twisted wire between th trough and rail. Height of the wire from the to of the trough is 16 in.

The trough is made of hardwood and measures 2 in. wide by 12 in. deep. This timber was urchased for a low price which reduced overall ost.

The ground at the site of the trough is "cor-uroyed" with brigalow logs to a distance of 12 ft. ack from the trough. Height of the top of the ough from where the cattle stand is 2 ft. 4 in. he road along the outside of the trough is graded p so that the road level is only 12 in. below the p of the trough. The grading up of the road ves the automatic feeder sufficient height to acilitate the pouring of feed into the trough. The rading also allows drainage of the road.

A yard such as the one described was intended allow for 100 head of steers. This gave them total yard space per head of 120 sq. ft. Shade pace of 18 sq. ft. and trough space of 2 ft. er steer is provided when 100 head are in feed.

In practice this yard has proved sufficient for 50 dehorned steers—aged about 12 months. This educed shade space to 12 sq. ft., yard space 80 sq. ft. and trough space to $1\frac{1}{3}$ ft. per steer.

In the summer time, however, it would be advisable to allow 18 sq. ft. of shade per steer.

When shades run east and west, the ground below the shade structures dries out more quickly.

Yards 3 *and* 4 are the same as yards 1 and 2 except that they are 200 ft. by 100 ft. which allows additional yard space, for 100 head. It is possible that such a yard could take up to 200 head but again shade space should be greater in the summer.

Wire netting has been wrapped around the trees to prevent them from being ringbarked by the cattle.

A 24 ft. concrete water trough serves two yards.

The water troughs are under separate shades from the main yard shade.

A "clover leaf" shaped drafting yard is used for drafting out fats. This design is described in Advisory Leaflet No. 166 "Handling and Drafting Cattle" which is obtainable on request.

Plate 3

Cattle in a Feedlot Become Very Quiet.

A horseyard is used for breaking in cattle to feed. Generally about 100 head are being broken in at one time in order to replace fat cattle forwarded to Cannon Hill.

A crush and slide bail is used for ear tagging, hormone implants or incidental treatment.

A scale is used. In each yard of cattle, a representative group is weighed so as to maintain a check on weight gains.

HORMONES

Up to date, results from hexoestrol implants have not been clear-cut. Sometimes the difference in weight gains has occurred in only one period of 28 days with other periods showing similar gains for treated steers and controls.

AVOID SETBACKS

On at least two occasions cattle were not making sufficient gains. On one of these occasions, scouring was the cause.

The use of oxytetracycline remedied the scouring. The other period of low gains was overcome by feeding well above the feed standards. Periods of low gains are costly and it can be sound practice to feed in excess of requirements in order to produce maximum gains.

The cafeteria method of feeding has been adopted. This amounts to keeping feed in the troughs all day and has several advantages, one being that all cattle are assured of adequate amount of feed (even with greatly reduced trough space per steer).

Feed amounts need not be 100 per cen accurate—providing that all cattle are assured minimum amounts of roughage and protein if the eat to appetite. As the ration is based on grai there is no risk of cattle receiving insufficie energy feed.

It is not suggested that rations should not b accurately mixed, but, at present, there is n practicable method of measuring the larg quantities of feed that are fed daily.

SKILLED LABOUR

Apart from overall efficiency in managemen it is of paramount importance that the person i charge of daily operations be intelligent an observant so that the least alteration in the eatin or general habits of cattle be reported.

When 600 head of cattle are in feed at once the total daily cost of the operation is over £50 If for some reason weights remain stationary fo 3 or 4 days, costs would greatly affect final profits

Under certain conditions the feedlot can provid an economic return.

Whilst conceding this, the grazier must kee in mind that he could fatten a steer on an acre o summer crop costing about £2 10s.—unde "Arcturus Downs" conditions; or on an acre o winter crop at the cost of from £3 to £6 p steer. The benefit of the feedlot, of course, is th once the feed is stored, it is a certain sourc of fattening whilst grazing crop—particularl winter crop—is not nearly so sure.

MOLYBDENUM FOR TOMATOES

If your tomato crop is slow to start and erratic in growth, then look for symptoms of molybdenum deficiency, said Mr. N. Aldridge, Adviser in Horticulture, Department of Agriculture and Stock.

Lack of this minor plant food is responsible for failures at all times of the year, especially when the crop is grown in strongly acid soils.

Pronounced variation in plant growth is a feature of molybdenum deficiency in tomatoes. Single plants or small patches may be stunted while their neighbours often remain normal. In severe cases the entire planting may be affected. Leaf symptoms are typical and may take th form of a yellow mottling between the veins, an a tendency for leaves to curl upwards and di back from the tips.

Fortunately this disease is easy to control. I molybdenum is applied as soon as symptoms ar noticed, there is every chance that the plant will grow and crop normally. In this case th treatment is a foliage spray of sodium o ammonium molybdate applied at the rate of ½ oz in 3 gal. of water. In many cases improvement in growth and cropping have been claimed from early applications of this chemical even when n obvious symptoms of deficiency were present a the time of spraying.

Star Role Of The "Big Four" Vitamins In Poultry Feeding

By E. N. TAYLOR, Formerly Senior Poultry Adviser.*

"We didn't worry about Vitamin A, Vitamin ", and all the others 20 years ago—why worry bout them to-day?", is a question which has een asked at poultry association meetings. The nswer lies in the scientific discoveries involving e nature and effect of nutrients contained in ods, their inter-relationship with disease and eir application in the more highly intensive ethods of production.

Poultry farming has moved in the space of 0 years from the open range, semi-intensive pe where birds derived nutrients direct from e land, to a situation in which they have been eprived of the soil, and have become utterly nd completely dependent for food on the rmer.

Birds are being bred to lay at a high rate, us increasing the demand for a highly nutritious pe of feed. The type of ration itself has been refined that layers can produce more eggs on ss feed than before, provided the new "high nergy" mash contains an abundance of nutrients compensate for the lowered food intake.

Of these, the vitamins form a major part. itamins are chemical substances which are und in foodstuffs in relatively small amounts, nd must be present in the ration to maintain e overall well-being of a flock. Over recent ears our knowledge of the individual role of itamins has been greatly enhanced as new vita- ins have been isolated and identified.

It does not mean, however, that our nutrition as been at fault, as many of these substances have been present in our mashes long before their identification took place.

It simply means that we know more about them, what their functions are, and how, during times when certain mash ingredients are in short supply or when environmental conditions alter, we can best make up for the possible vitamin deficiencies which may result.

A prolonged vitamin deficiency can generally be recognised by very characteristic symptoms which, when discovered in the early stages, can usually be treated by using high levels of the vitamin which is lacking. When, however, only a marginal deficiency occurs, a more confusing picture presents itself. There are no clear-cut symptoms. There may be loss of appetite, fall in production, lowering of resistance to disease. Any one or all of these may occur. If an infectious disease occurs it may respond to drugs but the pre-disposing cause could still be there. For example, it is known that heavy worm infestations often go hand in hand with a lack of vitamin A. We treat for the worms, but the vitamin A deficiency is still there. Those farmers who feed a "mash and grain" as opposed to an "all-mash" ration should almost double the vitamin additives as the grain considerably lowers the overall level of supplementary vitamins.

Perhaps a point overlooked by many farmers who mix their own mash, particularly those who do it by hand, is the thorough mixing of the supplements through the feed. You should always make a premix of the supplements, by adding them to a small amount of the mash ingredients, say about 2 per cent. of the overall quantity, and then you should mix this thoroughly through the total amount. By doing this, you will ensure that each bird obtains its quota of *all* nutrients.

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* The author's death occurred in Toowoomba shortly fter this article was written.

It is important to know that varying conditions may render some vitamins inactive.

There are a number of factors which can affect the nutritive value of the more important vitamins (Vitamins A, D_3, B_2 and E) and these are listed in Table 1. By studying this table carefully, farmers should be able to avoid many of the pitfalls which can be brought about through a lack of understanding of the stability of vitamins, and so prevent common vitamin deficiencies occuring in their flocks.

Vitamin A

Vitamin A promotes growth, nourishes mucous membranes, increases appetite, and increases resistance to infectious disease as well as to parasitic infestation. It is also essential for high egg production and hatchability. This was shown very conclusively in experiments at the Poultry Section, Rocklea Animal Husbandry Research Farm. Vitamin A reserves are stored in the liver, and this fact is of great importance to the biochemist in assessing the vitamin A levels in birds suspected of this deficiency. When chickens are hatched from hens on an adequate vitamin A level, they receive sufficient vitamin from the egg to last them for about 2 weeks. If they are then fed an adequate amount in their diet no deficiency should result. If, however, the parent's diet has been deficient and an insufficien level is added to the starter ration, symptoms o a vitaminosis A can appear within the first 2 weeks. Unthriftiness, failure to grow, eyelids "gumming" together, feathers ruffled (feature which develop by the third and fourth weeks) and many deaths are evidence of a severe deficiency. In adult birds, respiratory troubles are prominent. Nasal discharge with watery exudates from the eyes appear. Yellowish-white pustules develop on the internal surfaces at the back of the throat and the oesophagus (gullet) Production falls and worm infestation, quite often, is heavy. General unthriftiness is evident

Vitamin A does not occur as such in plan materials, but exists in the form of certain carotenoid pigments, which are converted into vitamin A in the body of the fowl. The mos abundant of such pigments are carotenes from green feed, and cryptoxanthin from yellow corn These compounds are often referred to as pro vitamin A. Fresh fish oils are the chief sources of true vitamin A in breeding rations. It may be mentioned here, as a matter of interest, tha the carotenoid pigment xanthophyll is the chie colouring matter of egg yolk although it does not function as vitamin A. The laying he

TABLE 1

Vitamin	Heat	Light	Oxidation by exposure to air	Oxidation due to rancid fats of animal origin	Other Factors
A	Destroyed rapidly at high temps. Slowly at low temps.	Stable	Rapid destruction	Destroyed . .	Destroyed by direct* contact with certai minerals—ground limestone, manganese sulphate, bonemeal, charcoal, sulphur, iron compounds, iodine and others
D_3	Extremely resistant	Stable	Slowly destroyed	Stable	Destroyed by direct contact with pulverised minerals
B_2	Resistant	Somewhat Unstable	Stable	Stable	Stable
E	Resistant	Stable	Stable	Destroyed by Oxidative changes brought about by rancid fats	Stable

* In the stabilised powder form of vitamin A, this possibility does not occur due to a protective envelope enclosing the vitamin A particles.

selectively transfers xanthophyll to the egg yolk along with smaller quantities of carotene and cryptoxanthin which, as mentioned, are carotenoids that have been converted to vitamin A.

Vitamin A and its precursors are readily destroyed by oxidation (that is exposure to air), as well as temperature, and the presence of certain minerals. This particularly applies to fish oils in the liquid form. For this reason it is important to supply flocks and breeding flocks in particular with freshly mixed mashes when fish oils of this nature are being used.

For some time now, specially prepared vitamin A products have been placed on the market in a stabilised form. This is a form in which the fish oil or other vitamin A preparation is protected from oxidation by air in a powder-capsule, thus allowing the product to retain its potency for a considerable period. Mashes can thus be mixed and held for much longer periods without the serious consequence of a lowering of the vitamin A content.

When adding vitamin A to the mash you should follow the manufacturer's instructions. The desired levels are as follows:

Breeders	4,000 I.U. per lb. of feed
Layers	3,500 I.U. per lb. of feed
Growers and chickens	2,500 I.U. per lb. of feed

There figures allow for safety margins, in cases of stress or other factors.

Vitamin D_3

Vitamin D_3 is unique inasmuch as it may be supplied either in the ration or manufactured in the body of the bird by the action of sunlight or ultra-violet light on the feathers.

Vitamin D_3 is closely related to the assimilation of calcium and phosphorus and consequently a shortage of this vitamin may cause rickets in growing chickens or a drastic lowering of egg production and hatchability.

There is also a carry over of vitamin D_3 from the hen to the chickens.

Vitamin D_3 deficiency is usually evident at about 3 to 4 weeks, although it may occur earlier if there is a deficiency in the parent hen's diet.

Vitamin D_3 deficiency produces fairly typical symptoms; chickens become unthrifty, walk with a rather stiff-legged gait, and do not move about readily. The beak and often the bones of the legs become rubbery. Beading of the cartilaginous junctions of the ribs on either side of the breast is usually present. Although these symptoms are typical of vitamin D_3 deficiency, they can be caused also by an imbalance of calcium and/or phosphorus in the diet. This aspect of the trouble should be looked into, and, measures taken to ensure that ample shellgrit or pulverised limestone is available to the bird for its calcium intake. If a good quality meat and bone meal is fed, calcium, and particularly phosphorus, should be in adequate supply to meet the requirements of chickens to 8 weeks of age.

Where birds have access to sunlight, vitamin D_3 deficiency is rarely a problem. However, during a continued spell of dull, cloudy weather, deficiencies may occur. Under the intensive system of housing and where cages are used, ample vitamin D_3 *must* be fed in the ration.

This vitamin, like vitamin A, is present in cod liver oil, and is thus fed conjointly with vitamin A. It can also be synthesised cheaply and is added to those vitamin A preparations which normally do not contain vitamin D_3.

As with any other supplement, it is essential that the instructions issued by the manufacturer be strictly followed. In cases where deficiencies have occurred, however, much higher levels than normal must be given to the affected birds in order that the deficiency may be corrected.

The desired levels are as follows:

Breeders and layers . .	350 I.U. per lb. of feed
Growers and chickens	140 I.U. per lb. of feed

These figures also, as in the case of vitamin A, allow for reasonable safety margins.

Vitamin B_2 (Riboflavin)

Riboflavin is widely distributed in common poultry feedstuffs. Very rich sources are livermeal, milk powders (buttermilk and skim-milk), whey powder, and green feed. Bran and pollard are also reasonable sources. Because it is essential for hatchability and growth, it is of particular importance to the hatcheryman, to the commercial egg farmer and the broiler table bird grower.

Riboflavin-rich products are therefore in great demand and often in short supply which influences their cost. There is thus a tendency to economise in the use of highly priced livermeals and milk by-products—with serious consequences. Fortunately this vitamin is now synthesised and is readily available at low cost to the poultry producer so that shortages of riboflavin-rich foods are not so serious as in the past.

Riboflavin is stable except in the presence of light. However, even in mixed feeds this does not constitute a problem, and loss of stability is very slight.

Lack of riboflavin in the breeders' diet can adversely influence hatchability of eggs due to embryonic deaths (deaths in the shell), which occur during the mid-incubation period as well as causing abnormalities of the embryo. Usually these dead embryos have what is called "clubbed down"; that is, the feathers, or down, instead of breaking through the skin remain encased and curl round themselves in tight little knots.

Symptoms of the deficiency in the chicks' diet usually appear at about 3 to 4 weeks of age. Diarrhoea and poor growth are the early symptoms, followed by a typical "curled toe" paralysis. Quite often a shortening of the long bones is observed as well as the legs and wings, thereby giving the birds a dwarf-like appearance.

When buttermilk powder (8 per cent.) or livermeal (5 per cent.) is used in the breeder ration and a balanced starter ration given the chickens, using similar amounts of either buttermilk powder or livermeal, there is very little likelihood of a riboflavin deficiency being present. However, when these products are difficult to obtain, synthetic riboflavin can be purchased readily at most chemists and used according to the manufacturer's directions.

Vitamin E

Vitamin E (alpha-tocopherol) is necessary for fertility and embryonic development and thus plays an important role in hatchability. In growing chickens, a deficiency in the diet produces "crazy chick" disease or nutritional encephalomalacia and another less common complaint known as "exudative diathesis", which can be recognised by haemorrhages occurring under the skin and in the joints. Most rations fed to poultry contain sufficient vitamin E in that portion of the mash comprised of plant origin. Mill offals are relatively rich sources and with the trend towards high energy feeds with a resultant reduction in the amount of fibrous mill offals used, it is likely that deficiencies of vitamin E could become more prevalent.

Stress factors increase the need for vitamin E. Rapid growth of the chicken, induced by modern high energy feeds, is an example of physiological stress, and "crazy chick" usually affects the fastest growing birds in the flock. Rancidity of fat associated with long storage of some meat and bone meals, fish oils and other animal products has the ability to destroy vitamin E or make it unavailable to the bird. Thus, although the diet may contain ingredients having reasonably high vitamin E levels, rancid fatty acids from animal protein in mashes can cause a deficiency.

"Crazy chick" disease usually occurs in chickens between 3 to 9 weeks. The bird first becomes drowsy and stands with its eyes closed. With the appearance of nervous symptoms, the gait becomes unsteady and paralysis develops. The bird falls on its side and remains there. Periodic convulsions then intervene with characteristic retraction of the head. The legs stiffen and the bird spins around with a head to tail movement using its wings as well as legs to propel itself. This is accompanied by a chirping noise of distress. Gradually, these convulsions increase in frequency until death intervenes. There is no cure for a badly affected bird as the brain damage which is caused by the deficiency is irreparable. Incidence and deaths vary usually from 1 per cent. to 5 per cent., although much higher percentages have been recorded.

If vitamin E deficiency occurs, it is always wise to change the mash immediately, lower the meatmeal content, and if possible use a bag of meatmeal of a more recent date of manufacture because of the likelihood of fat rancidity developing in meatmeal stored for a considerable time. Where fish oils are being used, examine these to see that they are not rancid. Potent fish oils retain their original appearance, whereas oxidised fish oils appear in layers showing, here and there, brownish discoloured strata. If this occurs, discard the oil and use a fresh lot. Where the vitamins A and D are in the "stabilised" powder form, rancidity is not expected to occur.

Vitamin E in synthetic form is now available and can be used to ensure adequate vitamin E levels in the ration. However, it is rather expensive and its use is indicated only in the feeding of broilers and in the ration of breeding birds when foodstuffs rich in the vitamin are in short supply.

Levels for vitamin E have not been investigated fully, but it has been suggested that the addition of 14 grams per short ton of feed is sufficient to prevent the appearance of "crazy chick" disease and for maintaining high fertility in hatching eggs.

Citrus Diseases In Queensland—3

By B. L. OXENHAM, Senior Pathologist.

This part, the third and last of the series, deals with diseases of the roots, trunks and branches of citrus trees.

The subtropical to tropical climate of Queensland's citrus growing areas favours a number of fungal diseases of the roots, trunks or tops of citrus trees. When the damage occurs in the trunks or branches, the symptoms are fairly obvious. However, the symptoms produced by diseases of the roots are more indefinite and particularly in chronic cases may be difficult to diagnose without resorting to excavation of the root system.

There are also various disorders which result in the type of damage usually referred to as "dieback". In each case it is necessary to look for the particular factor or factors which have caused the debility.

Key to Diseases of the Roots, Trunks and Foliage

1. Gumming and decay of bark near ground level	*Phytophthora Collar Rot*
2. Leaf yellowing, leaf fall and general thinning of canopy	*Phytophthora* or *Armillaria Root Rot*
3. Wilting and death of branches with white to pink cobwebby fungal growth on bark ..	*Pink Disease*
4. Gumming, decay of bark and death of wood above ground; without white to pink fungal growth	*Secondary Trunk and Branch Rots*
5. Twig dieback	*Due to Various Causes*

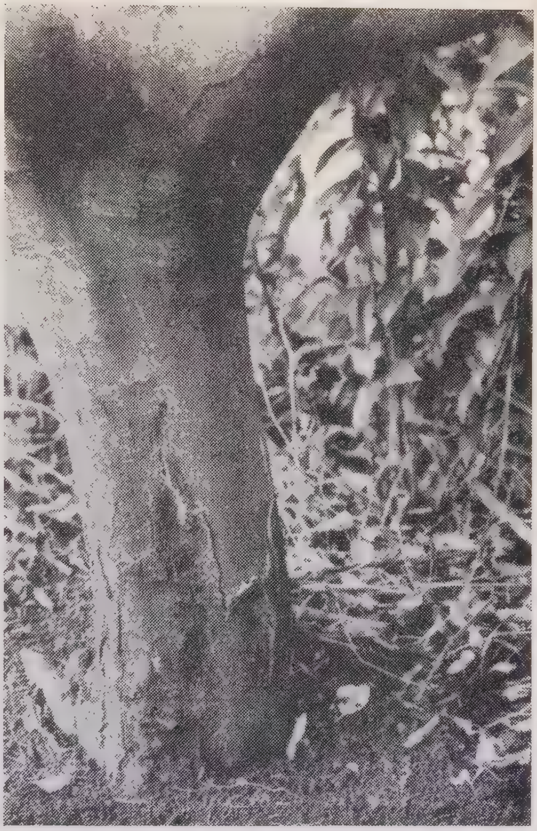

Plate 1

Collar Rot in Advanced Stage.

Phytophthora Root and Collar Rot

Phytophthora root and collar rots are found in all of Queensland's main citrus growing districts. Various local names such as foot rot, wet feet or gummosis may be applied to the disease but the cause lies in an infection by the fungus *Phytophthora parasitica.*

When the butt or the collar of the tree is attacked, the disease is easily detected. There is a dark, water-soaked rotting of the bark accompanied by the exudation of quantities of gum. As the decayed areas dry out, the affected bark shrinks and cracks (Plate 1). Below ground there is a softer type of rotting followed by a sloughing of the bark. It is necessary to remove the soil from around the base of the tree to see the extent of the damage. The decay may be confined to the area near ground level or extend over the butt and into the main roots. It is unusual for the disease to extend far above ground level.

The symptoms seen in the top of an infected tree are brought on by the partial or complete ringbarking of the base. Leaf yellowing is followed by leaf fall and there is a general thinning of the foliage (Plate 2). Subsequent new growth is weak and twig dieback is common. The decline may be confined at first to one side of the tree but if the disease extended there is a general collapse, often preceded by the setting of a crop of small fruit. The rate of decline from tree to tree varies considerably. Some may die within a short time, others dwindle on indefinitely.

The root rot phase of this disease is not so obvious and is often difficult to diagnose. The above-ground symptoms may range from the general appearance of starvation and decline described for collar rot to a chronic unthriftiness. Examination of the roots may reveal a sparse and rotting fibrous root system, or in more severe cases a rotting of the larger roots. If the disease is confined mainly to the fibrous roots, and root replacement cannot keep pace with the decay

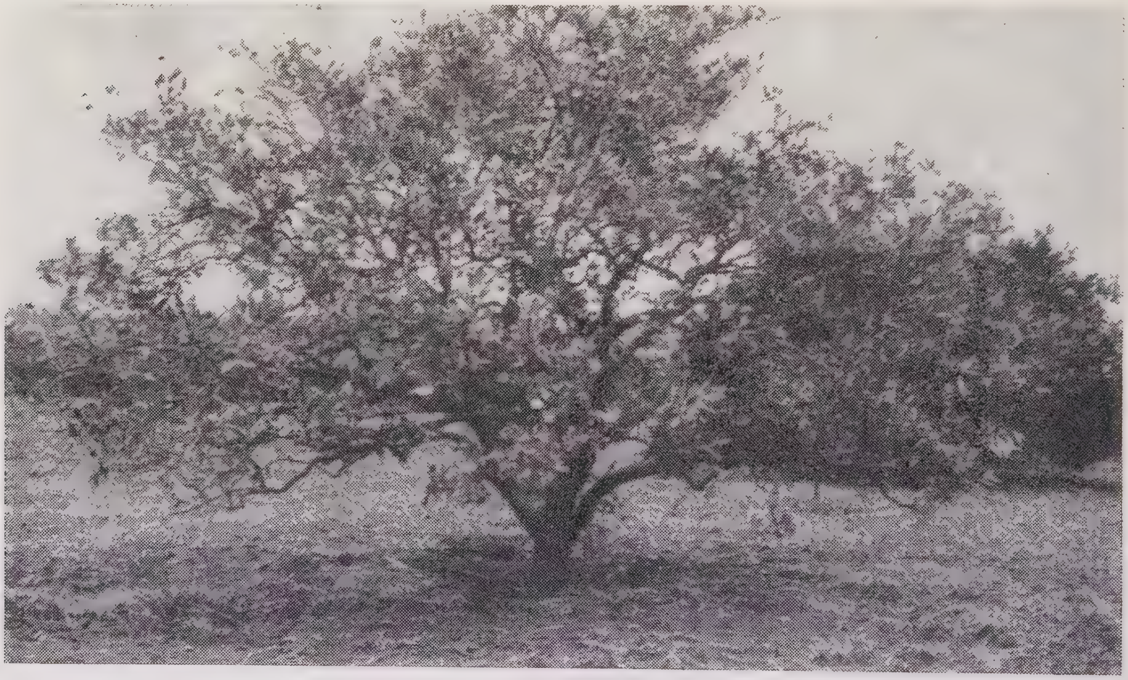

Plate 2

Root and Collar Rot. General symptoms of decline are evident in this affected tree.

there is a chronic lack of vigour in the affected trees. When the larger roots are also affected the tops of the trees show more spectacular symtoms.

Newly planted trees are very prone to Phytophthora root and collar rot (Plate 3) as are old trees past their prime.

Plate 3

Root and Collar Rot. This young tree is dying as a result of Phytophthora infection.

Contributing Conditions

The fungus causing root and collar rot lives in the soil and requires damp conditions for its multiplication and spread. Citrus trees growing in heavy, shallow or poorly drained soils are therefore prone to infection. Flooding of orchards occurs in some localities and unless the flood waters rise and fall rapidly, Phytophthora damage may result.

Prolonged periods of high rainfall will result in sufficient dampening of even fairly well drained soils for infection to occur. This type of weather is encountered regularly in districts such as the Woombye-Palmwoods area, and chronic root rot is common in these places. Although the root damage takes place in the wet seasons, the foliage symptoms are often most obvious in subsequent dry periods.

Rank weed growth around the tree trunks keeps them moist in wet weather and contributes to collar infection. Deep planting or faulty cultivation which allows the bud union to be covered with soil are dangerous. The bud union, or the tissues above, are then exposed to infection and often the scion is more susceptible than the stock.

The lower parts of the root system are most likely to be infected first, and affected trees must rely on healthy roots near the surface for food and water. Deep cultivation which destroys these surface roots will then aggravate the position.

Control

The use of rootstocks which are resistant to Phytophthora infection would be the most satisfactory approach to this problem. Rough lemon and sweet orange stocks are most commonly used in Queensland and both are susceptible to the disease. Sour orange and trifoliata are resistant. Sour orange cannot be used because of the ravages of the quick decline virus. Trifoliata is not very popular here at present because of slow tree growth under many conditions and the need to use virus-free scion budwood. Greater experience with trifoliata may, however, result in the overcoming of many of the present objections.

Mandarin rootstocks have some resistance and are being used on a wider scale. Cleopatra mandarin is popular in Florida and is being used in experiments in Queensland. Troyer citrange is also highly regarded in the U.S.A. but worthwhile seed supplies are not yet available here.

The fungus attacking citrus trees also infects other plants such as pineapples, strawberries and tomatoes and it is unwise to cultivate susceptible crops among young citrus trees. Replanting citrus within a few years of the removal of infected trees is also dangerous unless a resistant rootstock is used. Preplanting soil fumigation with the chemical Vapam has been found effective in America but is expensive. It may be practicable, however, to sterilize the planting sites when diseased trees are being replaced. The chemical is washed into the soil with enough water to soak the root zone.

It is of primary importance that only healthy trees are planted in disease free soil and that the fungus is not introduced with the planting stock.

Other measures which help to prevent Phytophthora damage may be summarised as follows:

1. Selection of deep, well-drained soils for citrus planting.
2. Artificial drainage works, where practicable.
3. Careful planting and subsequent cultivation.
4. Careful irrigation to avoid over-watering.
5. Weed control around the tree trunks.

Once trees are affected by root rot, little can be done to aid them. Artificial improvements in drainage to check surface water flow and also reduce subsoil moisture will reduce subsequent infection. Irrigation water should be carefully applied.

Trees affected by the early stages of collar rot may be treated surgically and recovery is often affected unless there is subsequent re-infection. As soon as the disease is noted, the soil should be removed from around the trunk by digging, or washing away with water from a power spray plant. Any rotting bark is cut away from the butt or the main roots, taking in addition half an inch or so of the apparently healthy bark bordering the lesion. The scars are then painted over with a copper paint made by adding a little water to one of the copper fungicides (Plate 4). After drying, the whole of the butt and surrounding soil may be sprayed with a copper fungicide at normal concentration. Unless there is danger of frost the soil should not be replaced until callusing is complete.

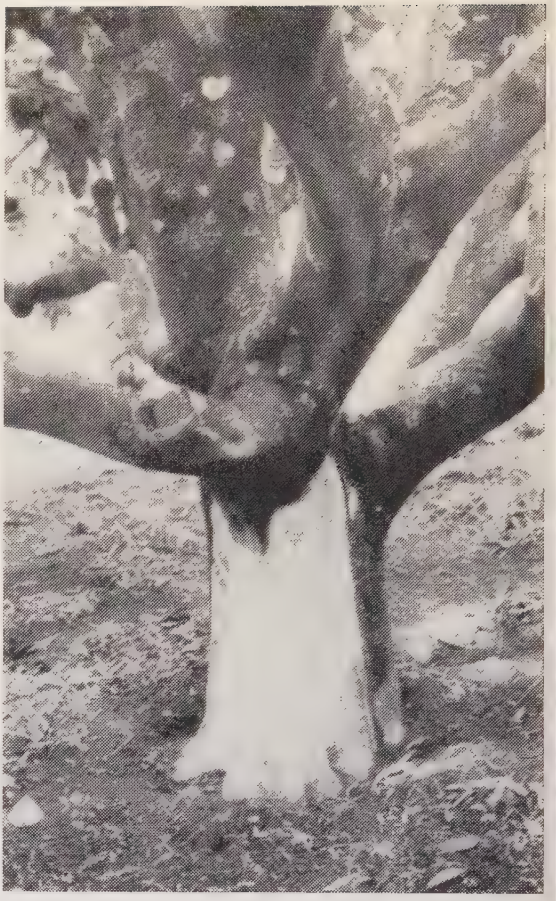

Plate 4

Surgical Treatment of Collar Rot. Affected areas of bark have been cut away and wounds painted with copper paste.

Drenching the butts of young trees and the surrounding soil with a copper fungicide is a wise precaution before and during the wet season if collar rot is known to be present in the orchard.

Armillaria Root Rot

Armillaria root rot is not nearly so common in Queensland as the disease just discussed, but nevertheless causes damage in some orchards established on forest soils.

The symptoms seen in the tops of affected trees resemble those produced by Phytophthora damage. However, when the butts of the trees are exposed black, string-like threads will be seen adhering to the roots (Plate 5). These threads are fungal structures and because of their presence the causal organism *Armillaria mellea* is often termed the "shoestring fungus".

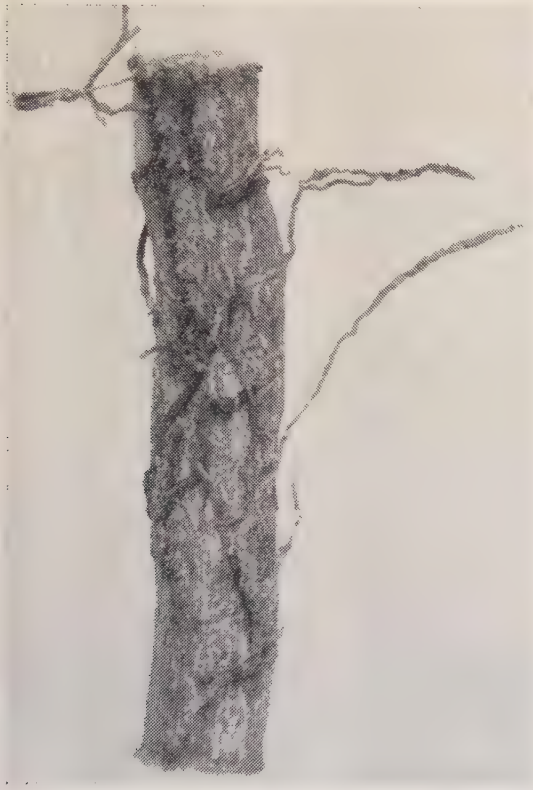

Plate 5

Armillaria Root Rot. Note the string-like fungal strands on the root.

The bark on affected roots sheds and is easily removed and a white fungal mat may often be seen underneath. There is an odour reminiscent of mushrooms associated with the dry rot of the butt and roots. Occasionally in wet weather, clumps of honey-coloured mushrooms may be seen near the base of a diseased tree. These are the fruiting bodies of the fungus.

Armillaria is a common parasite of forest trees and invades citrus roots when the trees are planted soon after clearing infested soil. During clearing as many as possible of the roots and fragments of stumps should therefore be removed. It has also been found beneficial to ringbark the trees some months before clearing, as Armillaria incidence is then reduced on the stumps and roots. Citrus planting should be delayed long enough to allow any remaining tree roots to rot away.

The fungus spreads from tree to tree by root contact and therefore often spreads in patches in the orchard. As soon as affected trees are noticed they should be surgically treated as described for collar rot. Any affected roots should also be cut off and pulled out.

If affected trees are removed, as many as possible of the roots should be lifted and the soil may be fumigated to safeguard the replants. Carbon bisulphide is injected 6 in. deep into holes 18 inches apart; 2 fl. oz. being injected at each point. The soil surface is then sealed by dampening with water or covering with wet bags. The site may be replanted about 2 months after treatment.

Pink Disease

Pink disease or "cobweb" develops following infection with the fungus, *Pellicularia salmonicolor,* which attacks many woody plants as well as citrus. It is most common in the humid, tropical districts but also occurs at times in the coastal areas of southern Queensland, particularly in orchards adjacent to rain forest.

The wilting and collapse of individual branches is usually the first obvious sign of infection. On closer examination, a white to grey or pink cobweb-like fungal growth may be seen extending over the bark (Plate 6). This is particularly noticeable in wet weather. As the branch is girdled the bark splits and lifts and the branch finally dies. Unless checked, the fungus will continue to spread through the limbs killing large portions of the tree.

As soon as the disease is first noticed, affected branches should be pruned out, the cuts being made well below the obvious infection. The cut surfaces are then painted with a copper fungicidal paste, and the prunings burnt. Once the disease has been observed it is advisable to make regular inspections, particularly during the humid months of the year.

Plate 6

Pink Disease. The conspicuous fungal growth can be seen on an affected branch.

Spraying the trees with a copper fungicide before and during the wet season has been recommended overseas and may be worthy of trial in affected orchards in Queensland.

Other Trunk and Branch Rots

Areas of gumming, bark cracking and dead wood are often encountered, particularly in neglected trees. This damage may be caused by various fungal infections which usually follow injury of some sort. Such injuries may occur as a result of drought, frost, sunburn, careless pruning, and insect attack. Secondary wood borers often tunnel through the affected tissues.

Damage may be reduced by keeping the trees in good condition with adequate fertilizing and pest control; by pruning correctly so as not to leave branch stubs; by painting large pruning cuts with copper paste and by protecting exposed branches with lime wash against sunburn. Drought or frost damage is often unavoidable but once injury has occurred the trees should be carefully tended. Any branches suffering from secondary fungal attack should be pruned out to avoid the spreading of the infection to healthy wood.

Twig Dieback

It is not usual for twig death in citrus trees to be caused by a particular disease affecting the twigs themselves. It is more likely to occur in response to some general factor adversely affecting the vigour of the trees. Drought, frost, root rot, unsuitable irrigation water, root nematodes, scale insect attack, spray injury and nutritional deficiencies can all result in twig dieback.

When the condition is noticed it is necessary to search for the factor initiating the damage. For instance, particular leaf discolorations will often indicate the presence of nutrient deficiencies, salt damage, spray injury or root rot. If the orchardist is in doubt as to the cause of dieback he is well advised to seek expert advice from an officer of the Department of Agriculture and Stock.

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FORESTALLING ELECTRICAL FAULTS

Tractor and engine delays from electrical faults can often be avoided if a careful check of all electrical components is carried out ahead of the busy season. These machines are often laid up in the "off season," but are expected to give peak performance immediately the season breaks.

Preventive maintenance of this kind will often save costly hold-ups at planting or harvest time, said Mr. C. G. Wragge, Agricultural Engineer, Department of Agriculture and Stock.

How Many Holidays Should A Cow Have?

By S. W. IVERS, Herd Recording Section.

Do you give your milkers a holiday every year? Or do you work them to the bone? These pertinent facts on rest periods for cows will perhaps help you in planning sensible vacations for the members of your dairy herd.

Man has improved the milk yielding capacities of cows by breeding better and more suitable strains and he has increased the length of time that a cow will milk. He has reduced the gap between the drying off period and date of calving. But this gap is sometimes reduced to dangerous levels when the cow is not permitted any rest from the milk-making process before she is due to calve again. This lack of rest period rebounds on the dairy farmer in consequential short lactations and/or lowered milk yields.

There are four very important reasons why a cow should have a spell:

(*a*) It enables her to rest her complex production mechanism.

(*b*) During this rest period, the store of minerals in her body can be replenished. There is a considerable drain on minerals from her body during each lactation.

(*c*) More of the nutrients from the feed consumed can be diverted to the growing foetus to give a strong healthy calf.

(*d*) Reserves of body flesh can be built up, and the cow is thus more fitted to enter a vigorous high-producing lactation.

When these factors are overlooked, nature reacts and the milk flow is reduced. Should there be competition for food between the growing calf and the milk-secreting organs, then the milk supply suffers. Unfortunately there is a carry-over effect from this, and the cow calves and enters her lactation more or less "off balance". She has no body reserves upon which to draw when the demands for increased production are made. Consequently, a partial drying-up process takes place and the cow cannot milk to her full potential.

Should it so happen that she enters a further lactation with insufficient rest period before calving, there is a further demand on an already depleted system, and production again suffers.

This is the principal reason why so many cows on indifferent levels of nutrition are "burnt out" so early in life. They are not given a chance to recover from the initial setback, and eventually give up trying to produce at anywhere near their potential level.

Treatment of Dry Cows

Therefore, when a cow dries off in poor condition, do not exile her to a dry paddock and forget her until she calves. Give her the same feed as the milking cows to assist her to put on "condition". This extra feed will be more than repaid by a stronger calf and greater volume of milk after calving.

Farmers in herd recording groups have found that to get production responses, a cow must calve in good condition. A cow in calf should not be "pushed about" on the farm by dogs. If she has to be changed from one paddock to another, let her take her time. Remember always that she could be carrying progeny capable of adding very considerably to your future income.

Bring in-calf cows into a maternity paddock near the dairy buildings.

Check them first thing in the morning and last thing at night.

Keep ample feed and water available otherwise your efforts will be in vain, and she will again calve in poor condition.

Length of Dry Period

Work carried out in Queensland has confirmed the necessity for a spell of 6 to 8 weeks to give maximum production. Here is what can happen to a cow's production when the dry period is varied:

TABLE 1

EFFECT OF LENGTH OF DRY PERIOD ON PRODUCTION

Dry Period (Weeks)	Average Production of Butterfat (lb.)
1 to 3	168
4 to 6	181
7 to 9	176
10 to 12	167
13 to 15	157
16 to 18	148
19 and over	137

TABLE 2

POSSIBLE LOSS OF INCOME

Dry Period in Weeks	Percentage of Cows Calving in Periods							
	20 cow herd		30 cow herd		40 cow herd		50 cow herd	
	25% £	33% £	25% £	33% £	25% £	33% £	25% £	33% £
1– 3 weeks	13– 3–0	17–10–0	19–16–0	26– 7–0	26– 7–0	35– 3–0	33– 0–0	44– 0–0
10–12 weeks	14– 3–0	19– 0–0	21– 7–0	28–10–0	28–10–0	38– 0–0	35–13–0	47–10–0
13–15 weeks	24– 6–0	32–10–0	36–10–0	48–17–0	48–10–0	65– 0–0	61– 0–0	81– 7–0
16–18 weeks	33–10–0	44–13–0	50– 7–0	67– 0–0	67– 0–0	89– 6–0	83–17–0	111–16–0
19 weeks and over	43–13–0	59–10–0	67– 0–0	84– 6–0	89–10–0	119– 4–0	111–16–0	149– 0–0

These figures have been compiled by the Herd Recording Section from a cross section of herds under test, embracing all standards of farm management. The loss in production on Queensland farms from too short dry periods amounts to many thousands of pounds of butterfat. Have you considered what your losses are if the bull runs with the herd and your cows are not permitted a rest period between lactations?

Here is some indication of the possible loss in actual income when cows are given a dry spell outside the period of 4 to 10 weeks. It is assumed that either 25 or 33 per cent. of the herd have less than 4 weeks' or more than 10 weeks' rest, and the remainder of the herd has a dry period within these limits.

These figures make you ponder on the steady loss of money that could be yours. They demonstrate the losses in production arising from short lactations and inability to milk to full capacity.

The average length of lactation of recorded animals for the past 5 years is shown in Table 3. Whilst the standard of nutrition on many Queensland farms is undoubtedly the principal ause of short lactations, farmers should not verlook the contributory effect of short dry eriods. This table illustrates the potential loss f income from short lactations because cows ave not been able to produce for a full 10 onths:

TABLE 3

Year	Average Length Lactation (Days)
1954–55	224
1955–56	229
1956–57	230
1957–58	247
1958–59	243

An analysis of individual cow productions carried out by the Herd Recording Section ndicated that cows which milked for a full 300-day lactation produced 75 lb. butterfat more than cows milking for 210 days. On the other hand, cows which had a 240-day lactation produced 25 lb. butterfat more than cows milking for 210 days. For each month the lactation was ncreased, the average production per cow ncreased by about 25 lb. butterfat.

You can imagine the effect this leakage of inance has on your cost of production. Cows having a succession of short dry periods tend to milk for shorter lactations. They are therefore in the dry paddock too long and are not earning income when they should be. As a consequence of this, farmers have to increase their milking herd to maintain milk quotas or at least maintain their level of income at something like a constant figure. But in milking the larger number of cows, their costs rise sometimes in a disproportionate ratio to the increased milk supply. In other words, it costs them more to produce this increased milk or cream than they get in financial return.

Plan to control the breeding pattern of your herd by—

(i.) Controlling the sire on the farm by the use of a satisfactory bull paddock.

(ii.) Keeping dairy records and noting returns to service; securing veterinary advice and guidance if necessary.

(iii.) Production recording your herd. This will enable you to evaluate individual cows. Herd recording information will provide the basis upon which to plan future breeding programmes.

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Prevent Pneumonia in Calves

Warm, dry housing and nutritious feed will go a long way towards preventing outbreaks of calf pneumonia.

Mr. K. M. Grant, Assistant Director of Veterinary Services, Department of Agriculture and Stock, said pneumonia is a very prevalent disease in calves. It often occurs after sudden cold snaps, especially if the calves are in poor condition. At other times, apparently healthy calves are affected. With these, there may have been no history of the disease and the diet may have been reasonably good.

Signs of calf pneumonia are rapid breathing, periodic coughing and a high temperature. The disease may be complicated further by calf scours which may become evident at any time.

Mr. Grant said that prevention of pneumonia rather than treatment should be the aim of every farmer. Provision of draught-free shelters and good feeding are the best defences. In addition, calves of different age groups should be housed separately.

The course of the disease is indefinite, and at the height of an outbreak death may occur in 24 hours. In other cases, however, animals may linger for 1 or 2 weeks, or else the calves may merely lose condition and develop a chronic cough.

Treatment with some of the modern antibiotics is very effective provided it is commenced early in the outbreak. The treatment, however, should be supervised by a veterinary surgeon, and farmers are advised to consult their District Veterinary Officer when there is an outbreak.

Once an outbreak of pneumonia has started, all affected calves should be isolated and the healthy ones shifted to a new housing site.

How Land May Be Obtained In Queensland

By A. E. FISHER, Information Branch.

Vast tracts of unused land no longer exist in Queensland. Practically the whole of the land suitable for primary production is being used either for growing crops or rearing livestock or for forestry purposes.

But a great deal of the land is underdeveloped, especially the bigger pastoral holdings.

The area of Queensland is 667,000 square miles, representing 22½ per cent. of the total area of Australia. The population is 1,500,000.

The State's pastoral lands are stocked with nearly 6 million beef cattle, or half of all the beef cattle in the Commonwealth. Sheep numbers exceed 23 million, and represent 15½ per cent. of the Australian total. Dairy cattle exceed 1 million.

For settlers, there are **three main sources of land** in Queensland (Plate 1):

1. **Freehold land. This may be either bought or leased from the owners through the real estate market or by private negotiation.**
2. **Crown land (that is, land in State Government ownership) not already leased may be obtained under one of a number of tenures, mainly leasehold.**
3. **Land held on lease from the Government may be transferred to another person under certain circumstances, the sale being through the real estate market or by private negotiation.**

I. FREEHOLD LAND

Although less than 10 per cent. of the State's land is held in private ownership (freehold), a large proportion of the agricultural and dairying country, and some grazing land, is in freehold tenure. This is indicated in the accompanying map.

Lessees who hold Crown land under Perpetual Lease Selection tenure, or the old tenures of Perpetual Lease Prickly Pear Selection and Perpetual Lease Prickly Pear Development Selection, are given the option of converting their leases to freehold tenure under these conditions:

1. The purchase price of the land under freehold tenure is to be the unimproved value of the land as determined by the Land Court.
2. The purchase price is to be paid in equal, annual instalments, without interest, over 20 years.

Settlement Farm Leases also are given similar rights of conversion to freehold tenure, or perpetual lease. Grazing selections up to 5,000 acres in area may be similarly converted.

II. NEW CROWN LEASES OR FREEHOLDS

Land becomes available from time to time under the tenures described below:

A. Through the Department of Public Lands.
   1. Agricultural Selections, which may be Perpetual Lease Selections or Agricultural Farms.
   2. Settlement Farm Leases.
   3. Grazing Selections, which may be Grazing Homesteads or Grazing Farms, both leaseholds.
   4. Preferential Pastoral Leases.
   5. Pastoral Leases and Pastoral Development Leases.

B. Through the Irrigation and Water Supply Commission.
   1. Agricultural Farms (freeholding tenure).
   2. Perpetual Lease Selections.
   3. Grazing Selections (leasehold).

TYPES OF TENURE DESCRIBED

A. Lands Department Tenures

1. *Agricultural Selections.*—Perpetual lease selections, as the name implies, are leases in perpetuity. These are capable of being converted to Agricultural Farms, which can be made freehold. The greatest area that may be held by any one person under Perpetual Lease Selection is 2,560 acres, but this limit is not likely to be allowed. The notification opening the land specifies in each case how much any one person may lease.

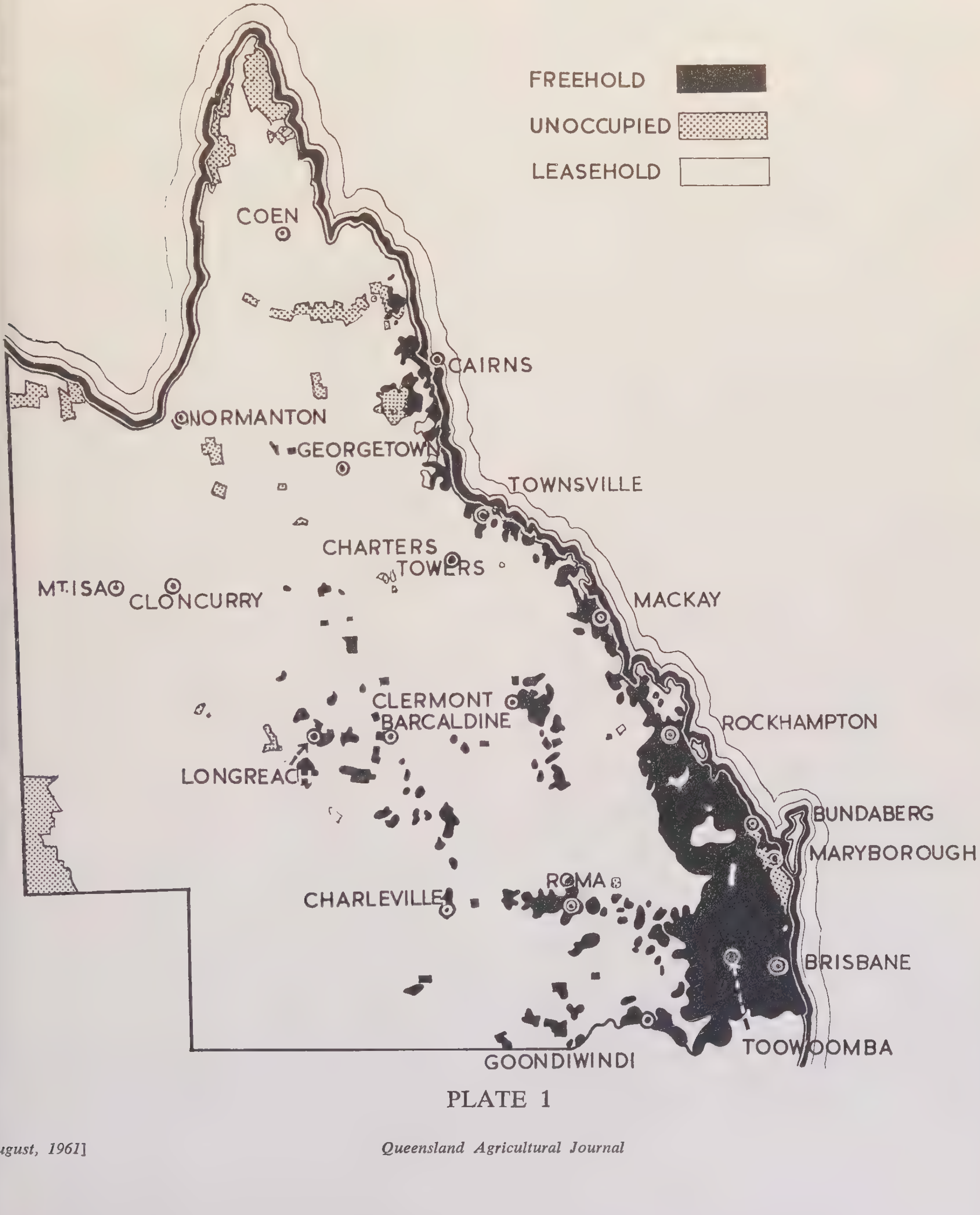

FREEHOLD
UNOCCUPIED
LEASEHOLD
COEN
CAIRNS
NORMANTON
GEORGETOWN
TOWNSVILLE
CHARTERS TOWERS
MT. ISA
CLONCURRY
MACKAY
CLERMONT
BARCALDINE
ROCKHAMPTON
LONGREACH
BUNDABERG
MARYBOROUGH
ROMA
CHARLEVILLE
BRISBANE
TOOWOOMBA
GOONDIWINDI

PLATE 1

The annual rent for the first 10 years of a Perpetual Lease Selection is 2½ per cent. of the notified capital value of the land. The annual rent for each succeeding 10-year period is determined by the Land Court at 2½ per cent. of the unimproved capital value of the land.

Special conditions in the lease may require personal residence by the lessee for a number of years and the provision of substantial improvements.

An Agricultural Farm tenure is for those who decide at the time of application that they wish to obtain a deed of grant for the land at the end of the lease period of 20 years. The purchase price is payable over that period in 20 equal, annual instalments, without interest.

2. *Settlement Farm Leases.*—The term of the lease may be up to 30 years. Rent for the first 10-year period is stated in the opening notification. The rent for the remaining periods is determined by the Land Court. The maximum area that may be held under this tenure is 6,000 acres. Conditions requiring personal residence by the lessee and the provision of developmental improvements are imposed.

3. *Grazing Homesteads and Grazing Farms.*—Under Grazing Homestead and Grazing Farm leases, the maximum area that may be held by any one person is 60,000 acres. The area that may be held by a person in any one district is also limited. Where lands exceeding a total area of 30,000 acres and opened under different notifications are applied for by the same person, a rental limitation of £600 a year must be observed as well as the conditions relating to maximum areas.

The term of a grazing selection may be for any number of years not exceeding 30. The opening notification declares the annual rent for the first 10 years, and the rent for each subsequent 10-year period is determined by the Land Court.

A Grazing Homestead is subject to the condition of personal residence by the lessee during the first five years of the lease. If it is transferred, each new lessee must personally reside on it for five years. A Grazing Farm, unless the opening notification exempts the selection from the condition of occupation, must be occupied continuously during the whole term of the lease by the lessee or his registered bailiff.

Every Grazing Homestead and Grazing Farm must be enclosed with a good and substantial fence in three years.

The lessee may be required to carry out certain developmental improvements within a specified time. Conditions requiring the lessee to destroy noxious plants are also imposed.

4. *Preferential Pastoral Leases.*—This tenure is generally used for areas greater than 60,000 acres. A preferential pastoral lease can be held only by individuals and must be used for the exclusive benefit of the applicant. It may be subject to the condition of personal residence for seven years, and to fencing and development conditions.

5. *Pastoral Leases and Pastoral Development Leases.*—The tenures of Pastoral Leases and Pastoral Development Leases are used for large areas in the more remote parts of the State. These may be held by individuals or by companies, and there is no limit to the area that may be held under these tenures. These leases are not subject to any residence or occupation conditions, but they may be subject to fencing and development conditions. The term is generally for 30 years, but they are subject to certain statutory rights of resumption for closer settlement.

B. Irrigation and Water Supply Commission Tenures

1. *Agricultural Farms (freeholding tenure).*—Under the tenure of Agricultural Farms, the greatest area that may be held by any one person is 5,000 acres, with the limitation that the area will not include more than 300 acres of land capable of being irrigated from the Commission's works. The term is 20 years, and the purchase price is payable in 20 equal instalments, free of interest.

2. *Perpetual Lease Selections.*—These leases are held in perpetuity. The greatest area that may be held by any one person is 5,000 acres, with the limitation that the area will not contain more than 300 acres of irrigable land. In practice, the areas allotted as leases are considerably smaller than the maximum areas. The notification opening the land specifies how much any one person may lease.

The annual rent for the first 10 years is 2½ per cent. of the notified unimproved capital value of the land. The annual rent for each succeeding

0-year period is determined by the Land Court 2½ per cent. of the unimproved capital value the land.

Conditions requiring personal residence by the ssee for the first three years, and the provision improvements within a certain time, may be nposed.

3. *Grazing Selections.*—Provision exists for e Irrigation and Water Supply Commission to lot grazing selections with maximum areas and onditions similar to those for Grazing Home-eads and Grazing Farms allotted by the Department of Public Lands.

In practice, the Irrigation and Water Supply ommission seldom opens land for new settlement as Grazing Selections.

HOW NEW LEASES ARE ALLOTTED

The demand for land in Queensland is keen, nd for Crown land thrown open for settlement, allots (determined by lot) usually have to be eld to determine the successful applicants.

Land in Queensland is continually reverting the Crown, either by the expiration of leases f large holdings, or in accordance with the esumption conditions of leases. Where land s situated in closer settlement areas and is capable f and suitable for subdivision, it is subdivided nd made available for closer settlement.

The areas into which it is subdivided are determined after assessing the capabilities of the land nd the use to which it will be put.

Since 1945, 14,738,689 acres in 422 separate eases have been allotted to new settlers under razing tenures.

Lands are allotted in the following manner:—

A. Lands Department

1. Public Competition.—Sheep and cattle razing blocks, except Pastoral Leases and astoral Development Leases, are usually opened or public competition by notification in the *overnment Gazette*.

How to Apply.—The procedure for applying or lands open for public competition by notification in the *Government Gazette* is this: The pplication, signed by the applicant personally, ogether with the necessary deposit of rent and urvey fee, must be lodged with the Land Agent or the district in which the land is situated at or before the hour at which the land is open. The application must be lodged by the applicant in person or by his agent appointed in writing under his hand. It must not be forwarded to the Land Agent through the post.

All applications are examined by the Land Commissioner in his judicial capacity. He then conducts a ballot among those applicants whose applications are in order. This determines the successful applicant.

2. Group System.—Under the "Group" system, applications are invited by public advertisement from persons qualified to apply, and lithographs are published describing the lands and setting out the general terms of settlement, together with the requirements of eligibility to apply for them.

To qualify for participation in ballots, each Group System applicant must satisfy a special Lands Department Committee of his suitability to hold Crown land. By means of information given in his application, he must show that:

(*a*) He is of an age suitable to undertake the development and management of the block or blocks applied for. (The minimum age is 18 years.)

(*b*) He is landless, or if he holds land, that such land, together with that applied for, will not exceed a living area.

(*c*) He has had pastoral or land experience of a practical nature for not less than three years.

(*d*) He can finance stocking and development of the block he may be successful in drawing at ballot. Approved financial qualifications include:

  (i.) Cash, readily convertible assets or livestock owned by the applicant;

  (ii.) Financial backing by a parent or other close relative of the applicant; and

  (iii.) An irrevocable guarantee by a bank or recognised wool selling broker, which company normally engages in the financing of rural lands.

How to Apply for Land.—To apply for lands under the Group System, intending lessees are required to make application for the particular block or blocks they are interested in, using the proper application form. This form is available from the Queensland Department of Public Lands, George Street, Brisbane. The application, when completed, should be forwarded to the Lands Department, Brisbane, together with the necessary preliminary deposit.

After the closing date, the applications are examined by a Lands Department Committee. Those applications that satisfy the Department's requirements are admitted to a ballot, by which the successful applicants are determined.

Applications must be completed fully and with care, as it is upon the information supplied by the applicant that his elegibility is decided.

3. Public Auction.—This applies to Pastoral Leases and Pastoral Development Leases, which are outside the scope of the average new settler.

B. Irrigation and Water Supply Commission

Allotment of land by the Irrigation and Water Supply Commission follows the same general pattern as that employed by the Lands Department in its "Group" system.

To qualify for participation in ballots conducted by the Irrigation and Water Supply Commission, each applicant must satisfy a committee from the Commission that he is a suitable person to hold Crown land. In his application he must show that:

1. He is between 18 and 55 years of age, and physically capable of working and developing the land.
2. He has had experience for a specified number of years in a particular branch of agriculture. For example, the notification may call for applicants with at least three years' experience in tobacco growing. On the other hand, experience in dairy farming, fat lamb raising or general agriculture may be required.
3. He possesses the minimum amount of capital set out in the notification.
4. He is not holding any farm capable of providing a reasonable living.

How to Apply For Land.—The Irrigation and Water Supply Commission advertises when farms are available. Intending lessees are required to make application for the blocks they are interested in using a special application form available from the Commission. The address of the Commission's Head Office is: Cnr. William and Margaret Streets, Brisbane. When completed the application should be returned to the Commission, together with the required deposit.

After the closing date, a committee appointed by the Commission examines all the applications. Those applications that satisfy the Commission's requirements are admitted to a ballot by which the successful applicants are determined.

An interested person may have his name placed on the Commission's mailing list and from time to time as farms become available particulars will be posted direct to him.

Rights of Aliens

A person other than a British subject is not qualified to apply for or to hold Crown leasehold land in Queensland without first having obtained a Permit under *"The Aliens Acts,* 1867 *to* 1958." This Permit may be obtained from the Under Secretary, Department of Justice, Brisbane.

A permit is not necesary for an alien to acquire freehold land.

III. EXISTING CROWN LEASES

All Crown leaseholds, including earlier ones under different tenures, are capable of being transferred to eligible persons under certain conditions. Transfers must have the prior approval of the Minister for Public Lands and Irrigation.

SOURCES OF FINANCE

The Queensland Government does not provide any special financial assistance for land settlement.

The main sources of credit for land development are:

1. Commonwealth Development Bank.
2. Agricultural Bank (Queensland Government).
3. Trading banks.
4. Pastoral brokers.
5. Hire purchase companies.

ACKNOWLEDGEMENT

The assistance of the Department of Public Lands and the Irrigation and Water Supply Commission in the compilation of this article is gratefully acknowledged.

Why We Put Seed To The Test

y Officers of the Seed Testing Station, Standards Branch.

How much useful information can a Seed sting Station supply after testing a sample of d? Do the results shown on a Seed Analysis port give a true indication of how the seed will w when planted in the field? Today, by using -to-date seed testing methods, which are still ing developed and improved, and aided by dern laboratory equipment, seed testers can e direct and satisfactory answers to these questions. However, before an attempt is made to te these answers, certain conditions regarding d sampling need to be observed.

ed Sampling

Accurate seed testing depends on accurate seed npling. The results of a seed test refer only the sample of seed received. The sample y be a few ounces or pounds in weight and the bulk of the seed from which it was taken y weigh hundredweights or tons.

In a large bulk of stored seed, temperatures ry in different parts of the stack. Moisture may concentrated in a section of poorly stored seed. ese conditions, if uncorrected, will ultimately ect the germination percentage of seeds in tain regions. Again, small light weed seeds d inert matter may not be evenly distributed but y have gravitated to sections of the bulk when seed was in motion (during the operation bagging, transporting, or storing). Therefore, d taken haphazardly from a portion of the bulk y not be a true sample. How important it is n that the sample forwarded for testing should nsist of seed taken from different parts of the ole stack and that the seed removed be oroughly mixed, so that when the final portion selected for despatch to the Seed Testing Station s truly representative of the bulk.

The next step is to carefully mark the sample cket not only to identify the owner and describe seed sample, but also to supply any helpful ormation about the seed which will enable seed ters to proceed as quickly as possible with the test. An example of the kind of information which should accompany a sample is a statement as to whether the seed has reached full maturity at the time of harvest.

Young crop seeds are often dormant or in a "resting" phase and do not germinate so quickly as matured seeds. The Seed Testing Station is therefore obliged to overcome this dormancy and accelerate germination by methods which include pre-chilling or drying the seed for a number of days exposing the seed to certain intensities of light or using chemical stimulants, the most important of which is a solution of potassium nitrate.

On receiving a carefully sampled package of seed and on being informed as to whether the seed is young or old, whether it has been treated with insecticides or fungicides, or whether there have been adverse factors operating at the time of harvest and storage which might affect the seed, the seed tester is ready to begin a test which can be completed in a reasonably short period. Modern seed testing methods enable accurate tests of most crop seeds to be completed in 1 week, but some grass seeds such as green panic and buffel require a period of up to 21 days for satisfactory tests.

The Purity Analysis

Testing of the sample begins with a purity analysis on a small weighed portion of the thoroughly mixed sample. The analysis is essentially the determination by weight of the component parts of the weighed portion of the sample. Each part such as whole crop seed, damaged crop seed, seeds of other crops and inert matter including the tiny seed leaves or glumes, straw and soil, is carefully separated and weighed. Mechanical aids are used by seed testers to carry out this separation accurately. These aids may consist of mechanical seed mixers, air blowers to carry off and collect light inert matter, transmitted light to illuminate the interior of seeds such as paspalum and, of course, finely adjusted chemical balances to weigh minute amounts of seed or other material.

A purity analysis carried out in this manner is highly accurate and is satisfactory for testing most seeds. It is known as the Irish method under the International Rules for Seed Testing. However, when grasses such as Rhodes are tested for export, an additional refinement is made in the analysis. This is simply a closer examination of the whole seed. Each apparently whole grass seed is re-examined to see if a true seed or caryopsis is present beneath the enclosing tiny seed leaves or glumes. If a caryopsis has not formed, the seed is removed and added to the inert portion. This system of purity analysis is known as the International Method and has arisen after international agreement relating to international trading in the export of grass seeds.

Results of the purity analysis are shown on a Seed Analysis Report. The purity analysis column in the report is divided into three groups for easy reference. The groups refer to the type of seed tested, the type being classified in "The Agricultural Standards (Seeds) Regulations of 1956" as either a general crop, a pasture legume or cereal, or a pasture or fodder grass.

Under the provisions of these regulations, there are fixed standards for each component part of each crop seed sample. When a part of the sample does not comply with the authorised standard, the infringement is shown in red ink on the analysis report and regulations regarding the treatment and disposal of the seed are enforced.

Space is also provided on the analysis report for prohibited weed seeds and restricted weed seeds. Prohibited weed seeds are those which are noxious pests and which would be harmful if introduced into clean areas where the seed might be planted after being sold. Obviously, all seed offered for sale in Queensland must be free of prohibited weed seeds. Restricted weed seeds are less harmful, but the maximum allowable percentage in a sample is also governed by a fixed standard.

Seed testers are required to identify each weed seed present in a sample and state its botanical name on the analysis report. To aid in the identification of seeds, modern seed testing stations possess catalogued specimens of seeds collected from all over the world.

The Queensland Seed Testing Station hold
over 2,000 specimens of crop and weed seed
for this purpose.

How much information, then, can be obtaine
from the results of a purity analysis? It inform
the owner of the seed just how much crop see
and how much valueless matter constitute th
bulk of his seed. If he is a grower, it lists the wee
pests present in his crop and thus leads him t
consult with his local officers of the Departmen
of Agriculture and Stock as to the best metho
of eradicating the weeds from his future planting
If he is a purchaser, it protects him from buyin
seed which might introduce new pests into hi
cultivation. As a merchant, it indicates th
amount of seed cleaning he may have to unde
take. Seed testing carried out by the Queenslan
Seed Testing Station also assists merchants who a
in the process of adjusting newly purchased see
cleaning machinery. By carrying out a number
purity analyses on the same line of seed bein
run through the machine, adjustments can b
quickly made to the apparatus. Undoubtedl
information obtained from a purity analysis
helpful, but nevertheless it is incomplete.

The results of a purity analysis fail to sho
how many whole crop seeds are alive and ther
fore able to grow. A germination test is nece
sary to obtain this information.

The Germination Test

Germination tests are carried out on the who
crop seed component of the seed sample a
results are shown on the analysis report as t
percentage of normal germinable seed present
the total number of seeds (usually 400) tak
at random from the purity fraction of the samp
and placed on germination trays. These tests a
not connected with the weight of whole crop se
present, as in the purity analysis. This meth
of endeavouring to germinate a fixed number
whole crop seeds is more accurate than attempti
to germinate a small weighed fraction of t
complete sample.

When necessary, seed is lightly dusted wi
mercurial, sulphur or other fungicidal dusts
prevent the growth of moulds in the watery ge
mination medium. It is then germinated on mo
flannelette or towelling in shallow covered tra
which are then placed in thermostatically co
trolled germinator cabinets.

Plate 1

Purity Tests Being Carried Out in the Main Laboratory at the Queensland Seed Testing Station, Department of Agriculture and Stock.

A number of these germinators are in use perating at temperatures which have been deterined as most suitable for the particular crop eed, and which, generally speaking, are related the seasonal conditions existing at the time of ormal sowing of the seed.

The germinating seeds are examined daily and nly normal seedlings are counted and removed rom the trays. Seed testers must be familiar with e many different types of abnormal growth in eedlings as these seedlings could not grow sucessfully in the field. A final germination count made when there is no likelihood of growth ccurring in any of the remaining whole crop eeds. The results are then entered on the nalysis report.

Provision is also made on this report for the esults of germination after using potassium nitrate olution. In certain seeds such as Rhodes grass nd tobacco, a comparison of germination results btained after using both water and potassium itrate solution as germinating mediums clearly ndicates the age of the seed.

Are germination results then only an indication f the number of whole crop seeds that may grow? ermination results show not only the percentage of the total number of whole crop seed present which has the ability to grow under suitable climatic conditions, but also the time taken for this test. Time required for seed to grow is a most important factor. Seeds which normally sprout rapidly such as Japanese millet and onion take longer to grow when the seed is old and has lost its vigour or germinating capacity. These "weak" seeds may give disappointing strikes when planted. Germination results should always be compared with the manner in which the seeds normally germinate in the field. The results, therefore, need to be interpreted in terms of time taken to grow as well as percentage germination.

How can the results of a purity analysis which are percentages by weight be linked with the percentage of whole live seed for easy reference? This is achieved by stating the pure live seed percentage on the analysis report.

The Pure Live Seed Percentage

The pure live seed percentage is therefore a useful combined figure for making a quick assessment of the condition of a bulk of seed. How this figure is obtained is shown in the following example: Suppose a seed test resulted in an 80 per cent. purity and a 75 per cent. germination.

The germination results show that only 75 per cent. of the total number of whole crop seeds in the sample can germinate satisfactorily. However, as shown by the purity analysis, whole crop seed present constitutes 80 per cent. by weight of the complete sample. Therefore 60 per cent. $\frac{(75 \times 80)}{100}$ of the sample by weight represents the actual weight of all pure live crop seeds present in the sample. This means that the purity analysis percentage which represents the weight of whole crop seeds in the sample has been divided into 2 parts according to the germination percentage. One part represents whole crop seeds which have the capacity to germinate, and the remaining part whole crop seeds which cannot grow under any conditions.

The pure live seed percentage is therefore an immediate indication of the amount of live pure seed in the sample, and as it is a percentage weight, it can be applied to any units of weight. Thus in the example illustrated, a 60 per cent. pure live seed means that 60 oz. in every 100 oz., 60 lb. in every 100 lb. or 60 cwt. in every 100 cwt. of bulk seed represents pure live crop seed which has the capacity to grow.

Scope of Seed Testing

Obviously, there is a vast difference between growing conditions in a seed testing station and in the field. On the one hand the laboratory environment approaches ideal conditions. Growth is maintained in an artificial climate and furthermore, the germination rate of certain seeds is accelerated in order to complete the test in a reasonably short time. On the other hand, seed in the earth is exposed to varying conditions of moisture, temperature and soil reaction. How can this difference between growth environments be reconciled so that the figures on an analysis report comply with anticipated results in the field?

Seed testing is not restricted to laboratory procedures. The growth habits of seeds when planted in the field are carefully studied and these finding are applied to seed testing methods. Thus when French bean seed is tested, the cotyledons or true seed leaves are opened after 4 days to determine the number of "baldheads" or seedlings with damaged growing points. This figure is then shown separately on the report. Again, centrosema seed has an improved germination in the field after being treated with concentrated sulphuric acid. The acid softens the hard seed coat and when the seed is planted, the abrasive actio of the soil acting in conjunction with soil moistur assists in its rapid growth. However, this aci treatment has been found to be useless in aidin rapid germination in the laboratory. Nevertheles it has been observed that when centrosema see is scarified by hand in a seed testing station, ger mination results obtained approximate closely t results obtained in the field. The many differen methods used in seed testing are therefore base on observable facts. Whenever seed testin methods which tend to aid rapid germinations ar used in a test, remarks concerning the method used are shown on the analysis report.

At the present stage of progress in seed testing the information supplied by a seed testing statio to a farmer or merchant is therefore of consider able value. The results shown on a seed analysi report cannot predict how seed will behave unde adverse climatic conditions in the field. It doe however, describe the condition of a bulk of see in practical terms.

Seed testers are not content to rest on th progress they have made up to the present tim Investigations are continuing into methods more rapid tests on normally slow growing seed and more effective means of determining puritie particularly in chaffy grass seeds. Problems su as the difficulty in germinating hard seeds legumes, and methods of identification of seeds distinct hybrid strains, are receiving attention.

Modern seed testing now operates on a worl wide basis. There is a constant exchange of ide and developments between seed testing stations the international network. The Queensland Se Testing Station is a member of the Internation Seed Testing Association and takes an active pa in check testing of "referee" samples which a received from overseas. Results of these tes are compared with the results obtained by oth stations. These activities lead to a greater unde standing of seed testing problems and aid se testers in finding a solution. The practical valu of this work is the maintenance of sufficiently hig standards to ensure that only high quality seed imported or exported.

The Seed Testing Station, Standards Branc Department of Agriculture and Stock, Brisban tests more than 10,000 seed samples annuall Tests are made free of charge on any seed fo warded by an owner for his own sowing. A sma charge is made for each test when the seed is be offered for sale.

Tuberculosis-Free Cattle Herds

(As at 13th July, 1961)

Aberdeen Angus

dle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
others, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

x, T. L. & L. M. J., Seafield Farm, Wallumbilla
ookey, J., Arolla A.I.S. Stud, Fairview, Allora
vis, W. D., "Wamba", Chinchilla
nnis, L. R., Diamondvale A.I.S. Stud, Mundubbera
wards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
ans, E. G., Lauraven A.I.S. Stud, Maleny
een, D. B., Deloraine A.I.S. Stud, Fairdale, via Wondai
ading, C. A., "Wilga Plains", Maleny
nry, Mrs. K., & Sons, P.O. Box 4, Cambooya
nschell, W., "Yarranvale", Yarranlea
M. State Farm, Numinbah
tleton, H. V., "Wongalea", Bowenville
ller, W., Bore View Past. Co., Bore View, Pickanjinnie
arquardt, A. C. & C. R., "Cedar Valley", Wondai
Shane, A. H., Handford Road, Zillmere
ears, G. S. & E., "Morden", M. S. 755 Toogoolawah
ore, S. R., "Sunnyside", West Wooroolin, via Kingaroy
ale, D. G., "Groveley", Greenmount
Sullivan, Con., "Navillus", Greenmount
Sullivan, P. W., "Navleigh", MS 371, Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

dgeon, Est. C. E. R., Marionville, Ayrshire Stud, Bald Knob, Landsborough
nn, T. F., "Alanbank", Gleneagle
ans, E. R., Stimpsons Pty. Ltd., Loganlea
ddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

arendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
cdonald, S. E. G., Conondale Rd., Maleny
rrison, E. J., Cedar Creek, via Closeburn
umann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah
Superintendent, Marsden Home for Boys, Station Rd., Nth. Booval

Guernsey

ss, W. H., Degilbo, via Biggenden
tcher, A. B., "Cossart Vale", Bonnah
lmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
nson, G. L., "Old Cannindah", Monto
ller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton
Wilson, J. R., "Okeden", Proston

Jersey

ckingham, C., Trout's Rd., Everton Park
t, W. C. M., Pine Hill Jersey Stud, Gundiah
rchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
rrows, R. N., Box 23, Wondai
grave, P. J. L., The Craigan Farm, Aspley
rpenter, J. W., Flagstone Ck., Helidon
nochie, I. S., "Brooklands" Jersey Stud, Sherwood Rd., Sherwood
awford, R. J., Inverlaw, Kingaroy
rm Home For Boys, Westbrook
wler, P. & Sons, "Northlea", Coalstoun Lakes
ench, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
rley, G. W. & P., "Hopewell", East Nanango
M. State Farm, Palen Creek
tton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
anson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

derson, J. H. & Sons, "Inverary", Yandilla
gel, W. D., "Summerhill", Murgon
l, W. W., Mathalla
itton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Growing Tobacco In Competition With Nut Grass

Plate 1: **A Good Tobacco Crop Grown in Dense Nut Grass.**

By N. H. ADAMS, Senior Adviser in Agriculture.

There are several species of nut grass in Queensland. The best known and most troublesome is *Cyperus rotundus*. It has a wide distribution throughout the world, and is recognised as a problem in most of the warmer regions. In Queensland it does not normally set viable seed, propagation being by tubers or "nuts". It is most commonly seen in alluvial soils adjacent to creeks and rivers. Once established, its spread may be rapidly aided by mechanical means such as cultivation equipment and irrigation water.

Nut grass has a chain-like rooting system with tubers joined by rhizomes. The top tuber shoots, while those below remain dormant until the chain is broken. This peculiarity makes nut grass difficult to eradicate. In deep friable soils odd tubers have been found at a depth of several feet. However, root studies have shown that about 80 per cent. of tubers are usually located in the top 6in. of soil, and most of the remainder are in the next 6 in.

Nut grass draws heavily on soil moisture and nutrients and invariably reduces the net returns from all row crops. Nevertheless, many crops are farmed profitably despite nut grass competitio While most tobacco growers take pains to avo cropping in nut grass land, there are a number farms on which the problem must be faced they are to stay in production.

The establishment of the tobacco industry close settlements and particularly in communi irrigation schemes provides conditions conduci to the spread of nut grass. However, man farmers in these areas are doing an excellent jo of keeping their land free of this pest. Experien has shown that efforts in this regard are well wor while.

Preventing Its Spread

Cultivation equipment is probably the greate spreader of nut grass. It is a wise precaution keep a close watch on machinery, ensuring th tubers are not carried on to clean fields. Irrig tion water is another common medium by whic nut grass is spread. The installation of scree or traps at the entrance point might well be th means of preventing a farm becoming infested wi nut grass. Plate 2 shows one type of scre ound to be effective in the Burdekin irrigation rea. It has a mesh of three-eighths in. and is esigned so as to reduce clogging by grass and ther floating matter. A bird-wire screen or ne wire netting placed upstream from the trap ill also assist in delaying blockages.

Farmers must be constantly alert for any out-reak of nut grass patches in clean fields. Small atches can be eradicated by fumigating with ethyl bromide. It is preferable to hand-fork he patches, and in most cases 2 lb. of methyl romide per 100 sq. ft. will give a complete kill. arge areas caused by a flood or other means can e eradicated by spraying with 2, 4-D using 3 lb. f acid equivalent per acre. This treatment is ffective provided it is applied immediately the ubers shoot and before the plant has time to evelop a chain of nuts.

ontrol Investigations

For several years the Department of Agricul-ure and Stock has conducted trials with the pur-ose of examining various methods of controlling nut grass. This has involved the testing of new weedicides in addition to ways and means of growing crops in competition with the grass.

Work done at the Ayr Regional Experiment Station has shown that nut grass density can be substantially reduced by cultivation under hot dry conditions. Most of the tubers are located in the surface soil and, with high temperatures and low moisture availability, may be readily killed through dehydration.

When weather conditions are favourable for nut grass growth, 2,4-D will give an effective control.

The first step is to cultivate thoroughly with the purpose of breaking the rhizomes and separating as many tubers as possible. This upsets the apical dominance and allows greater numbers to germinate. Three weeks after the shoots appear they should be sprayed with 2,4-D at 3 lb. acid equivalent per acre. A wetting agent will assist in obtaining a good foliage cover. Continued treatment has been known to eradicate nut grass completely.

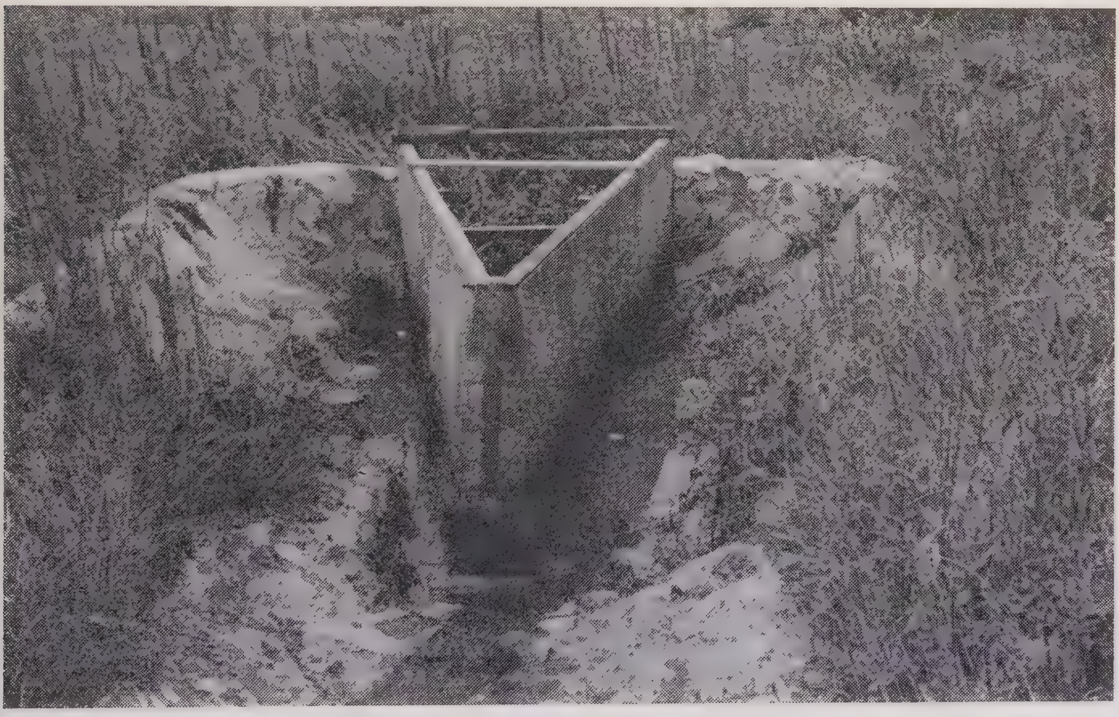


Plate 2

A Nut Grass Trap Set in Position. Note that the trap is pointed upstream.

Plate 3

Eradication of Small Patches of Nut Grass. Fumigating with methyl bromide under plastic.

Investigations with tobacco have shown that it can be grown successfully despite nut grass infestation. It has also been demonstrated that costs are excessive and yields poor when the farm programme does not incorporate a suitable rotation.

Growing Tobacco in Nut Grass Land

Nut grass is favoured by annual row cropping under irrigation, and in these circumstances its density of stand can build up alarmingly. On the other hand it has been shown that the menace of nut grass is greatly reduced when the rotation includes 3 years of grass ley before tobacco. Rhodes grass gives a good dense cover and has proved very effective for this purpose. Not only does the grass cover supress nut grass, but it ensures that the soil is in good physical condition for the subsequent tobacco crops. Rhodes grass will give a good germination and quick response when planted in the summer rainy season.

If the nut grass is well established and exceptionally dense, it is advisable to reduce the stand before sowing to grass. This can be done by dry cultivation over several months, followed by 2,4-D application when rain promotes good nut grass development. This weedicide can also be applied if necessary after the Rhodes grass has been established.

Preparing the Land

Good judgement is required in handling a dense body of grass in the preparation of land for tobacco. Make the first ploughing after the close of the summer rainy season, while there is just sufficient soil moisture left to rot the bulk of the grass. Subsequent working will be determined by weed growth. When the soil becomes dry most damage to nut grass can be done by shallow working. Do not overwork land, particularly if the nut grass population is light.

If rainfall builds up soil moisture and promotes nut grass activity, it is advisable to change over to 2, 4-D weedicide treatment. Tobacco is very susceptible to hormone weedicide injury and under no circumstances should it be applied within 6 weeks of planting.

Experience in the Burdekin has shown that ematodes are usually extremely active in nut rass infested land. They must be controlled for ne tobacco crop to be successful. Apply the umigant accurately in soil sufficiently moist to eal under the roller. It is the usual practice to llow 3 weeks of fumigation before disturbing ne soil. At the end of this period most of the pical tubers will have germinated. Cultivate the nd thoroughly at this stage with tines so spaced o ensure that all nut grass plants are destroyed.

ertilizing and Planting

A nut-grass-free period of 10 to 14 days can e expected after an efficient preplanting cultivaion. This is a critical period giving plants the pportunity of becoming well established before ncountering severe nut grass competition. Apply ne fertilizer immediately after the tine cultivation, nen irrigate and plant as soon as possible. It is nportant to place the fertilizer accurately so that is readily available when the plants begin to row.

Fertilizer requirements will vary with different soils and seasonal conditions, but it is generally greater when the crop is competing with nut grass. The crop should move evenly and steadily away from the nut grass. Side-dress backward patches with a suitable nitrogenous fertilizer such as nitrate of soda or urea. Do this as soon as the patches are noticed.

Quality planting material is all-important. Plants must be strong, healthy and well developed if they are to recover quickly from the shock of transplanting. Normally, one flat teaspoon of seed will plant 100 sq. ft. of seedbed, which is sufficient for one acre of transplants. When dealing with nut grass allow one flat spoon of seed to 160 sq. ft. of bed. This will permit a good selection of plants from thinly planted beds.

Row Cultivating

Experience has shown that early and close cultivation can be handled more accurately when using tractors with forward cultivating gear. The

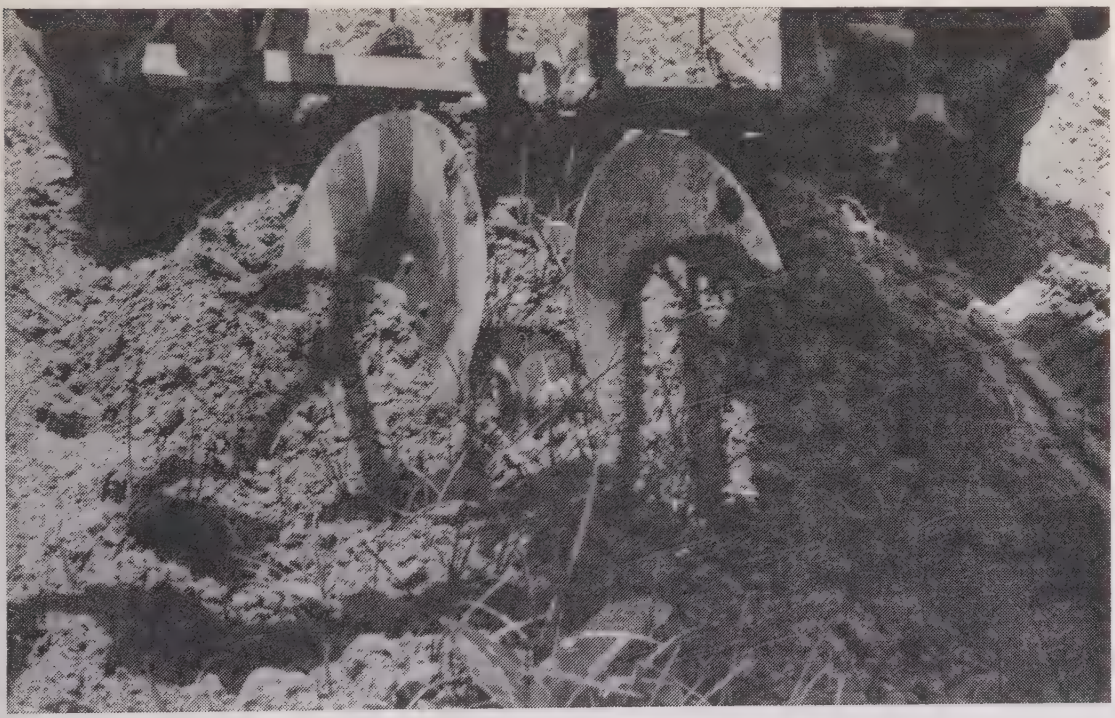


Plate 4

An Early Cultivation of Tobacco in Nut Grass. Discs set in front to give close, shallow, cultivation without damage to tobacco plants.

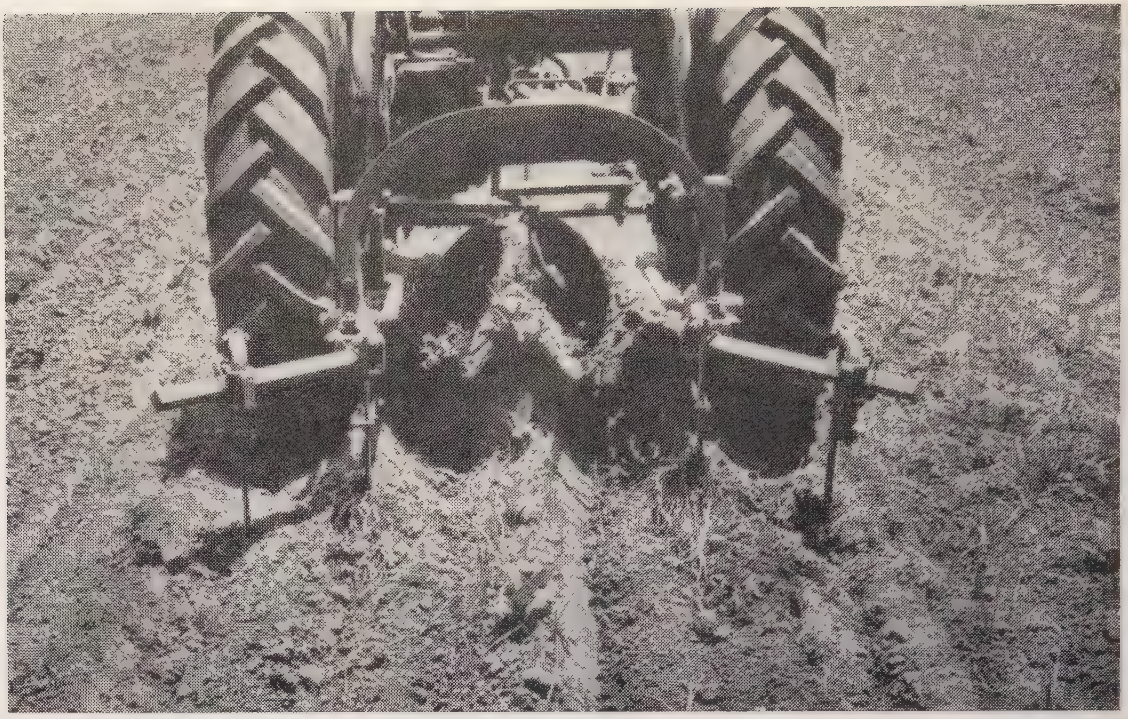


Plate 5

An Early Cultivation of Tobacco in Nut Grass. Rear view; land left relatively flat.

wiggle-tail type cultivator is also very efficient for close work, although it has the disadvantage of requiring an extra man. In the Burdekin area, a modification of the wiggle-tail has been made by attaching a seat and hand-operated tillage equipment to a rear-mounted cultivation unit. In this case the close work is done by the second man operating the hand cultivators. Carefully-set-up equipment will keep down costs of hand hoeing.

For the purpose of checking weed growth and conserving moisture, make the first cultivation within a few days after planting. This is normally a tine cultivation, except in the case of furrow irrigation, when a disc or sweep is attached on one side to fill the planting furrow. Care must be taken so that the cultivation is close without disturbing plant roots.

The next cultivation will be required in the second week by which time the nut grass has had ample time to shoot. It is advisable to use small discs in front, set at an angle to take a shallow cut away from the plants. The follow tines return soil towards the plants so that land is left flat. (Plates 4 and 5 demonstrate early cultivation of tobacco in nut grass lan

If nut grass density warrants chipping, ha hoe the narrow strip between the plants follow this cultivation. Do not attempt close chipp as it is better to leave the nut grass shoots un the plants rather than risk disturbing and dam ing their roots. A chopped-off nut grass pl can produce regrowth at the rate of 1 in. a d while a dislodged tobacco plant may take week to recover.

The second to fifth week after transplanting a critical period in which the battle against grass can be lost or won. Cultivate as often necessary to keep down nut grass under constant c trol, and be sure that the tobacco plant does suffer a check in growth through insuffici moisture or plant nutrients. In most soils, g moisture to a depth of 12 to 15 in. at plant ne will satisfy plant requirements for at least weeks.

Further chipping should not be necessary. As e plants develop, more soil can be moved wards them, smothering and checking nut grass ong the row. After the final hilling, nut grass ases to menace a healthy tobacco crop.

ecommendations In Brief

Keep fields free of nut grass by closely checking achinery and irrigation water. Small patches n be eradicated by fumigating with methyl omide.

Three years of grass ley before tobacco will ppress nut grass and ensure good physical con- ion of the soil for the subsequent tobacco op.

Nematodes must be controlled. Apply soil fumigant accurately and seal with roller.

Fertilize before planting, making sure that it is in a position readily available to young plants.

Good strong healthy seedlings are essential.

Crop growth must not be checked through inadequate moisture or nutrients. Side-dress backward patches with a nitrogenous fertilizer as soon as they are noticed.

Cultivate closely without disturbing the roots of the tobacco plant, and as often as required to keep the nut grass under constant control.

Nut grass will not trouble a healthy tobacco crop after the final hilling.

Plate 6

Tobacco is Not Troubled by Nut Grass After Final Hilling.

Brucellosis-Tested Swine Herds (As at 13th July, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilston Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., 225 West St., Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Baker, R. L., "Baroma", Glenapp, via Rathdowney
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Campbell, J. W., "Bunya", Bell
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Coulsen, B. L. R., Wondai
Dower, R. J. & E, A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
Glasser, D. H., "Yagaburne", Goondiwindi
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warree", Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Rosevale, via Rosew
Mack, A. J., "Culzean", Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, L. R., "Sunny Hill," Ascot, via Greenmount
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Pigg Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Sedgwick, F. G. & J. I. E., Mundubbera
Stanton, H. R., "Lanherne" Stud, Tansey, via Goomeri
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Farm For Boys, "Canaan" S Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Cooper, G. J., Neumgua
Coulsen, B. L. R., Wondai
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn," M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzean", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Alexander, Lunde, "Vanda", Biddeston
Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Coulsen, Mrs. H. M., Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jarvis, O., Wondai
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., 225 West St., Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton," M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Port Curtis Co-op. Dairy Assn. Ltd., Stud Piggery, Biloela
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young, R. & C., "Dudley Park", Biggenden

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Stone Fruit Pests In The Granite Belt

By M. BENGSTON, Entomologist.

This article describes the major pests of stone fruits in the Granite Belt and provides control measures for use by the grower.

Neglect of these pests will drastically reduce one fruit production in the Granite Belt, so n understanding of them will assist growers to an control measures that provide the greatest rotection at the least cost.

ruit Fly

All stone fruits are susceptible to fruit fly attack. ings in immature fruits usually show as small arkened spots in the skin and these spots may ecome more conspicuous as the fruits ripen. ffected areas often weep a small quantity of ice which draws attention to the sting. Some the stung fruits may wither and fall or be hed following larval development. All fruits ung when in the soft stage decompose rapidly.

Rainfall and high humidity, when fruits are pening, favour fruit fly activity. Stinging can ccur from mid-October onwards but depends on e occurrence of good rains. Hot, dry conditions ill suppress stinging until fruits ripen, or may revent damage entirely.

The use of lure traps will provide definite formation on the need for preventive spraying. x to 10 traps should be hung singly, away from e direct rays of the sun, in leafy trees.

A reliable stock lure formula is:

10 oz. pulped orange
½ oz. rock ammonia (ammonium carbonate)
1 pint water
1 tablet corrosive sublimate

An equivalent quantity of other soft fruits may be substituted for the orange. This stock lure will store for several months in a well-stoppered bottle. To charge the traps, 1 part of stock lure is mixed with 30 parts of water. Traps should be inspected regularly and the lure changed weekly.

A sweep spray of DDT 0·2 per cent. or a full cover spray of DDT 0·1 per cent. should be applied at the first sign of fruit fly activity as indicated by trap catches.

Green Peach Aphid

The green peach aphid is a serious pest of peaches and nectarines. It occurs sometimes on other stone fruits although damage normally is not serious. Trees are attacked in spring and early summer, the most conspicuous symptoms being curling and discolouration of the young leaves. At first sight this damage may be confused with leaf curl, a fungus disease, but closer examination will reveal the presence of large numbers of aphids. In a severe attack, blossoms and young fruit are shed and terminal dieback follows the death of affected leaves.

The green peach aphid is best controlled by a combined spray of DDT 0·1 per cent. and superior oil 3/100 gal. appiled at bud movement.

Black Peach Aphid

The black peach aphid, a serious pest of peaches, attacks nectarines also, and to a lesser extent plums and apricots.

Aphids are present on infested trees throughout the year, either on the roots or above ground, but the most obvious damage occurs during winter and spring. Aphids, as colonies, are first noticed on the undersides of the laterals, but later move over the trees, attacking leaves, flowers and fruit. Leaf distortion is less than that caused by the green peach aphid. Ants on the trees are a useful guide to the presence of black aphids.

As for green peach aphid, control is best achieved by a spray of DDT 0·1 per cent. plus superior oil 3/100 gal. at bud movement.

Scale Insects

San José scale may be an important pest of stone fruits. It is grey, pinhead sized and most commonly seen on the bark where it causes a scurfy appearance. Severe infestations kill leaders, and occasionaly young trees.

Grape scale, which is shiny brown, elongate and up to a quarter-inch in length, can be troublesome on plums and apricots. It does much less damage than San José scale although severe infestations reduce tree vigour and yields.

Both scales are controlled by a spray of superior oil 3/100 gal. applied at bud movement.

Mites

Several species of mites attack the various stone fruits but only Bryobia mite and red spider are of major importance.

Bryobia mite, which is dark red and overwinters as red eggs on the tree, is quite readily controlled, but if neglected will damage severely any stone fruit.

Red spider is normally important only on plums. It causes bronzing of the leaves, and heavy infestations may result in premature leaf fall. Numerous pale yellow and black mites, somewhat smaller than pinhead size, can be seen feeding on the undersides of the leaves. The presence of these mites will distinguish it from the fungus disease, rust, which has a somewhat similar effect.

A superior oil spray 3/100 gal. at bud movement is recommended for all stone fruits, and i addition plums should receive a summer spray o kelthane 0·05 per cent. if mites appear at tha time.

Light-Brown Apple Moth

Larvae of the light-brown apple moth fee on both leaves and the surface tissues of frui They favour areas between touching fruit o where leaves overlap fruit. The larvae can b recognised by their characteristic fast-wrigglin action and their habit of parachuting on a stran of silk when disturbed.

The light-brown apple moth has a wide ho range, including all the deciduous fruits an lupins. There is no definite overwintering stag as breeding continues slowly on available host Damage generally is worse on vigorous trees wit a heavy crop.

DDT 0·1 per cent. should be applied at th first sign of pest activity, which often occur towards the end of October.

CONTROL PROGRAMME

Fruit	Time of Application	Pests	Spray Formula
Apricot and plum	Bud movement	Scales, mites ..	Superior 3/100 gal.
Peach and nectarine	Bud movement	Scales, mites, aphids	Superior 3/100 DDT 0·1%
All fruits ..	Late October ..	Light - brown apple moth	DDD 0·1%
Plum	Late spring-early summer	Red spider ..	Kelthane 0·05%
All fruits ..	As indicated by trapping	Fruit fly ..	DDT 0·2 (sweep spray)

Scientific Names

Black peach aphid ..	*Anuraphis persicae-niger* (Smith)
Bryobia mite ..	*Bryobia praetiosa* Koch
Fruit fly ..	*Strumeta tryoni* (Frogg.)
Grape scale ..	*Eulecanium persicae* (Geoff.)
Green peach aphid ..	*Myzus persicae* (Sulz.)
Light-brown apple moth	*Austrotortrix postvittana* (Walk.)
Red Spiders ..	*Tetranychus telarius* (L.) and *lambi* Pritchard and Baker
San Jose scale ..	*Quadraspidiotus perniciosus* (Comst

When the answer to the question "Will it ash?" is "yes"—as it mostly is these days—e home-maker goes home happy and confident at she has nothing to worry about.

But sometimes her satisfaction is short-lived, d she vows not to believe such assurances gain.

There are times when her dissatisfaction is arranted, but unfortunately there are times hen the fault lies with the homemaker.

In pointing out that the consumer must play er part by providing the correct washing contions, Miss Nancy Foskett, Senior Extension fficer, Women's Service, N.S.W. Department of griculture, lists the following points to member:

- Never allow the article to become too soiled so that severe washing conditions are unavoidable.
- Wash as soon as possible once the article is too soiled to use. This is desirable to reduce the time during which dust and grease could penetrate fabric and fibre; and during which some chemical changes may occur if greasy soil.
- Use correct type and quality of detergent, and make sure it is thoroughly dissolved before adding clothes to wash water. In some instances too much cleanser can affect dye-stuffs, and so the colour of the article.
- If washing in a machine be sure to adjust washing time to type of fabric.
- Avoid bleaching—but if it becomes necessary be sure to follow directions closely.
- Never use bleach on "non-iron" garments unless the washing instructions permit its use.
- Be sure to rinse materials thoroughly—more "bad coloured" washing is the result of not rinsing out soap and dirty water.
- Don't allow damp, coloured articles to come in contact with others.
- Don't dry articles by an electric fire—the intense heat may affect the colour, as well as cause scorching.
- Don't leave or hang coloured wet articles in bright sunshine as the intense light can cause rapid light-fading.
- Don't sprinkle water on lustrous textiles before ironing—this usually causes marking.

Many Uses For Soap

Housewives are reminded that there are other uses for soap besides washing. Here are a few:

Minor cuts and grazes.—Soap is a disinfectant, so clean minor cuts and grazes with soap and water first!

Spectacles.—Eye-glasses will not steam up as readily if rubbed with soap-suds then polished with a tissue of lint-free cloth.

New shoes.—Before wearing new shoes rub a little moistened soap round the inside of the heels and leave them to dry. This softens any rough spots and helps prevent blisters and soreness.

Fingernails.—Housewives' nails suffer from messy jobs like cleaning stoves, pots and pans, or gardening. Before starting jobs like these, scrape fingernails down a bar of soap. When the job is done, the soap will wash off and leave the nails clean.

Beauty Hint.—Mild soap is good for cleaning most skins. It has been claimed that "the best formula for beauty is soap and sleep"!

Drawers and Doors.—When drawers and sliding doors are hard to slide, use soap! Rub soap on the drawer edge or sliding panel and you will notice the difference at once.

Keeping Children Busy.—A bar of inexpensive kitchen or home-made soap can be given to a small child for modelling. A child with a blunt penknife can let his creative imagination loose on a piece of soap. There is no waste; flakes and cuttings can be used for washing, while the child can use his creation during his bath times!

Keeping Marble Clean

With the advent of hot weather, stain and scratch resistant materials and finishes on table and bench surfaces need very little more than wiping over and drying with a brisk rub to keep their surface polish.

Even so there will be some homemakers with marble surfaces to care for.

Marble is to some extent porous, and although the surface is "stopped" and polished in manufacture, stains are still fairly readily absorbed.

For this reason they should be rinsed o immediately and the surface wiped dry.

An occasional wash with soapy water followe by rinsing, and later, the sparing application c a little silicone type wax polish will maintain th appearance.

Avoid excessive use of polish on white marbl as it may yellow the surface.

Where rings made by red wine and coffe have dried, they may respond to sponging wit a solution of a desertspoonful of borax dissolve in ½ pint warm water. Alternatively, a wea solution of Mangars Sugar Soap may be trie Followed by a clear water rinse.

Marks which are difficult to move may respon to application of lemon juice or vinegar, bu because of their slightly solvent action, the should be rinsed off after a moment or two.

Cigarette burns and marks from spirits tend t "eat" into the marble.

The removal of this type of stain should b undertaken only by those used to handlin marble.

This is because restoring of a polished surfac is a highly skilled operation as it usually entai removing a fraction of the surface to the dep of the stain, followed by re-stopping and buffi the surface with pumice powder.

The use of a paste abrasive or fine sandpap by an unskilled person would leave a dull surfac

—*N.S.W. Agriculture Department's "Press Notes".*

Permanent Pleating

Permanent pleating of pure wool garments for both men and women is a service readily available to people in the capital cities throughout Australia.

But few country centres in the Commonwealth are yet in a position to have permanent pleating carried out locally.

Yet the effectiveness of the process developed by the C.S.I.R.O. under the name of "Si-Ro-Set," is known far and wide.

The process is best known for its application to men's trousers and women's skirts. It is not only effective, but it is simple and cheap.

Once they are Si-Ro-Set, pleats are unaffect even so prolonged immersion in water.

The Australian Wool Bureau recently produce a special pamphlet dealing with Si-Ro-Set an listing the firms licensed to carry out the proce in each State. Country people who want the new woollen garments permanently pleated wi then know where to send them.

These pamphlets are available free on applic tion to the Technical Section of the Australia Wool Bureau, 578 Bourke Street, Melbourne.

esearch On Food

Initial research at the Department's new Food eservation Research Laboratory will be on its and vegetables, it was announced at the icial opening of the Laboratory in July. Cost- g £180,000 to build and equip, the establish- nt consists of a library and offices, as well as ysiology, microbiology, chemistry, and food chnology laboratories, and a series of cold oms.

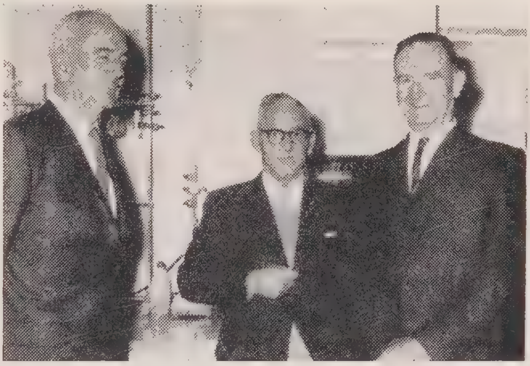
The physiology section will be concerned with veloping improved methods of storing, trans- rting, and ripening Queensland horticultural ops, in order to eliminate much of the wastage ich takes place between production and nsumption. It is hoped, also, to determine ether it is possible to export to distant markets greater variety of Queensland-grown fruits and getables.

The chemistry section will investigate changes stored and processed foods, particularly fruit ality, which is so important in the marketing a foodstuff.

The microbiology section will be occupied h the identification and control of spoilage ganisms in fresh and processed foods, and with veloping methods for the use of fruit residues.

The food technology section will concentrate on proving methods of canning, freezing, and hydrating fruits and vegetables, developing a der range of tropical fruit products, and pro- cing on a semi-commercial scale a number of re fruit juice concentrates.

The official opening of the Laboratory, uated in Harbour Road, Hamilton, was carried t by the Premier of Queensland, the Hon. F. R. Nicklin.



OP: The Premier of Queensland, the Hon. G. F. R. klin, performs the opening of the Food Preservation search Laboratory. On his right is the Minister Agriculture and Forestry, the Hon. O. O. Madsen. NTRE: Officers of the Agriculture Department at opening were (from left), Mr. W. J. S. Sloan, ector, Division of Plant Industry, Dr. W. A. T. mmerville, Director-General of the Department, and W. Webster, Deputy Director-General. BOTTOM: pecting the fruit juice concentration plant are: Hon. O. Madsen, M.L.A., Dr. S. A. Trout (Director the Laboratory), the Premier, Dr. W. A. T. mmerville, Mr. R. E. Leverington (Food Technologist) a visitor, Mr. W. Knox, M.L.A.

Plate 1. **Stock Food Analysis by an Agricultural Chemist.**

Stock Foods; What Are They Made Of How? And Why?

By A. C. PEEL, Standards Officer, and R. J. B. LINNET
Inspector, Agricultural Standar

The object of this article is to advise on the basic objectives of feeding stock, to explai certain terms used with respect to stock foods, to discuss the chemical composition of man types of feed, and to describe most of the feeding materials in common use in Queenslan As prepared stock foods have now assumed an important part in our livestock feeding programm their method of manufacture is described together wtih the machines used in their compounding

The most obvious purpose in feeding stock, as with humans, is to produce new tissues, and in young stock this is most evident in increased growth. With more mature animals or birds, the more important purposes of stock feeding a in the restoration of tissues destroyed in normal functions of the body, rebuilding energy used in milk or egg production or reproduction of young.

The objects of stock feeding may, therefore, summarised as follows:

(1) To produce new tissues and develop organs.
(2) To repair waste tissues.
(3) To reproduce young.
(4) To maintain body heat.
(5) To secrete various products.
(6) To undertake work.
(7) To build up reserves.

COMPOSITION OF STOCK FOODS

All living plant or animal tissue consists of the llowing:—

(1) Water
(2) Organic material
(3) Minerals or ash.

ater

Water constitutes by far the greatest part of all owing plant and animal life. Approximately ree-quarters of the animal body consists of ter, up to 80 per cent. moisture is contained in shly cut, succulent hay and as much as 20 per nt. may be contained in freshly harvested grain. the storage of hay or grain these percentages ust be quickly reduced otherwise the produce ill become mouldy and consequently unfit to be d to animals, also with the attendant generation heat, spontaneous combustion could result. The aximum moisture permitted under the Agri-ultural Standards (Stock Foods) Regulations for ain being offered for sale in Queensland is 14 r cent. and this is a safe upper limit for all grain storage. A maximum of 12 per cent. is permis-le in hay and chaff.

Because water constitutes such a large part of nt and animal life, it must be there for some ecific purposes, the most important being—

(1) To help the plant absorb nutrients from the soil and to carry nutrients in solution or suspension throughout the plant or animal structure.
(2) To assist in the many chemical reactions which take place in nutrient assimilation by plants and in the digestive processes of animals.
(3) To maintain temperature of animals and plants.
(4) To provide substance in individual cells of animal and plant life by keeping the cell walls fully distended, thereby maintaining the shape of the animal or plant.

The water or moisture content of a stock food is estimated by subjecting a weighed sample to a temperature slightly in excess of 100 deg. C. until constant weight is obtained. The weight difference is due to moisture.

Organic Material

After moisture has been evaporated (at boiling point—100 deg. C. or 212 deg. F.) from plant or animal tissue, the dried matter on being burnt is generally said to release organic material in gaseous form with the ash or mineral matter remaining. This is not strictly true; for instance, sulphur, which is a mineral but is also a component of proteins, may be partially released in the form of gas and conversely, carbon, a basic constituent of all organic matter, may be retained in the ash.

Organic material contains carbon, hydrogen, and oxygen, nitrogen and sulphur. It is conveniently classified under the following headings, each of them having an important place in stock feeding:

(1) the nitrogenous compounds, of which the *proteins* are the best known;
(2) the nitrogen-free compounds comprising the following groups—
    (*a*) fats and fat-like substances such as oils
    (*b*) carbohydrates
    (*c*) fibre

Proteins.—This is one of the most important groups in stock food classification, but it is sometimes felt that over-emphasis is given to it at the expense of other groups which, for their particular purpose, are indispensable. However, proteins are an essential part of all living things, being the main constituent of both the nucleus and the protoplasm of every living cell. As far as animals are concerned, the cell walls are composed mostly of protein, as distinct from plants, whose cell walls are composed mostly of cellulose, referred to as fibre. Proteins are chiefly the flesh-forming nutrients of stock foods but also supply heat and energy and body fats.

The complete study of proteins is vast and complex and certainly beyond the purpose of this article. It is sufficient to say that proteins consist of carbon, hydrogen, oxygen and nitrogen and in some cases also sulphur and phosphorus. Their outstanding chemical property is that, on complete decomposition by treatment with hot concentrated acids or alkalis, or at the proper pH with proteolytic enzymes, a mixture of amino acids is produced.

From a study of the composition of the proteins, it has been found that plants are able to form molecules of proteins from sulphur, phosphorus and nitrogenous compounds absorbed in aqueous solutions through the roots, combined with carbon dioxide absorbed through the leaves, and with carbon, hydrogen and oxygen derived from carbohydrates present within the plant.

It has been found, by the chemical reactions outlined, that proteins are composed of a large number of amino acids which unite with one another in a vast number of combinations to form the large group of proteins that exist.

While plants have the ability to synthesize proteins, as explained, animals have not this power, but can only form proteins to build up body tissues from the amino acids which are formed by the decomposition of plant proteins in the digestive process. All of the amino acids necessary for the formation of proteins must therefore be supplied by the foodstuff. Lack of any one will result in an unthrifty animal.

Together with the proteins, there are also present in stock foods other nitrogenous organic compounds, which for the purpose of stock feeding are grouped with the proteins under the expression "Crude Protein". Because the proteins of stock foods contain on an average of 16 per cent. nitrogen, the percentage of crude protein in a food is calculated by determining the nitrogen content and multiplying by 6·25, that is $\frac{100}{16}$.

This determination is carried out by the Kjeldahl method.

During the determination the nitrogen in the sample is converted firstly to ammonia and then to ammonium sulphate by boiling with concentrated sulphuric acid, aided by a catalyst and an accelerator.

The ammonium sulphate is then distilled wit excess caustic soda, and the ammonia which liberated is collected in a standardised boric ac solution.

The quantity of acid reacting with the ammon is determined by titration and calculation, and each millilitre of this acid is equivalent to a know quantity of nitrogen, the nitrogen and hence t crude protein may be calculated.

Fat.—Fat is essential for the production heat and energy in an animal; it is not flesh forming as protein is. Fat is the general ter applied to fats and oils, which are of simil composition except that at ordinary temperatu fats are solid whereas oils are liquids.

Fats are composed of carbon, hydrogen an oxygen in differing amounts, with carbon an hydrogen predominating. The three elemen combine in varying proportions to form fat acids, which when further combined with glyceri form the substances called fats. The rever reaction occurs when fats become rancid or a digested by animals, free fatty acids bei released.

In stock food analysis, ether (petroleum spiri is used to extract the fat. There are, howev components other than fat present in plant l which are soluble in ether, and these are grou with the true fat under the general term "Cru Fat".

Carbohydrates. As the name suggests, the are composed of carbon, hydrogen and oxyge with hydrogen and oxygen always present in t same proportion as they are in water, that is, twi as many hydrogen atoms as oxygen. Carboh drates belong almost exclusively to the plant kin dom, only very small amounts being found the animal body as carbohydrates. However, mo carbohydrates are easily converted by the dige tive process into other compounds which a readily assimilated and stored in the animal bo to provide the main source of energy and maintain heat.

With the aid of sunlight, carbohydrates a formed in the growing plant by the combinati of carbon dioxide and water, the simple carb hydrates being developed by the plant into mu more complex organic compounds including co plex sugars, proteins and fats. This is the w known process of photosynthesis.

The carbohydrate group includes—

(1) Sugars

(2) Starch, dextrin, &c.

(3) Gums, resins, &c.

Sugars may be simple or compound, the latter eing developed from the former.

Starch consists of a great number of molecules f glucose—one of the simple sugars—and is n extremely complex chemical compound. Starch the form of carbohydrate which is stored by ost plants, particularly in the grains of cereals ich as wheat, approximately two-thirds of which re starch, which forms the food supply of germin-ting seed to the stage where the growing plant able to assimilate nutrients through the roots r leaves. Underground tubers or roots such as otato tubers and arrowroot are also high in arch content.

The third group, gums, resins, &c., are not of nterest for feeding purposes.

Fibre. The substance known commonly as ore is essentially the chemical compound called llulose, which is the main constituent of the ell walls of plant life. Of more complex chemical omposition than starch, but as with starch, comosed of many molecules of glucose, this constitunt of plant life is by its chemical composition carbohydrate. In stock food analyses, however, is generally reported separately from other arbohydrate material.

The percentage of cellulose (or fibre) varies the different parts of a plant such as the stem, aves or fruit and of course the older the plant e more fibrous is its nature. As an instance, d, stemmy lucerne hay has a higher fibre content an young, freshly cut, leafy lucerne hay, and e higher the fibre content, the less digestible the food, although with ruminant animals such the cow, fibrous foods are digestible and have se as roughage.

The fibre content of stock foods is determined "crude fibre" and is the insoluble residue sulting from the digestion of the food for 30 in. each in a 1·25 per cent. solution of sulphuric id and in a 1·25 per cent. solution of sodium ydroxide.

Ash or Mineral Matter

As stated previously, after water has been evaporated from plant material and the organic matter removed by burning, that which remains is called the ash, which contains the mineral constituents of the food. As also remarked earlier, however, this is not strictly true because minerals such as sulphur may be burnt off in gaseous form and carbonates (that is material containing carbon, an essential component of organic material) may remain in the ash.

It is a well-known fact that plants require for their satisfactory growth minimum quantities of minerals such as phosphorus, potassium, sulphur, calcium, iron and magnesium, and if these are deficient in the soil they must be added in the form of fertilizers. In fairly recent years it has been found that in addition to these so-called major elements, plants also require minute quantities of other minerals, any slight deficiency being critical in the normal development of the plant. These have been named minor or trace elements simply because they are present invariably in extremely small amounts and not because they are minor in importance for the maintenance and development of plant life. They include copper, boron, zinc, manganese, molybdenum and cobalt. All minerals assimilated by the plant are retained by them as constituents of complex organic chemical compounds.

In a similar manner, animals require adequate supplies of minerals such as calcium, phosphorus, potash, iron, etc., for bone and teeth formation and as constituents of blood, muscle and flesh, and normal body functions cannot continue in the absence of an adequate mineral supply. As with plants, so animals require minute traces of minerals to overcome certain deficiencies, for example, copper in minute quantities has overcome the condition of "steely-wool" in sheep.

Plant foods normally do not contain sufficient of all the minerals to meet the requirements of animals and these must be added in the form of mineral supplements or licks. However, addition of excess amounts of such minor elements may cause toxicity in both animals and plants.

DESCRIPTION OF STOCK FOODS

Now that something has been learned of the chemical composition of animal and plant life and of the functions served by the various chemical compounds, such as proteins, carbohydrates and so on, it is possible to examine more critically some of these stock food materials.

These may be divided into the following groups:

(1) Plant products

(2) Animal by-products

(3) Miscellaneous products

(4) Compounded mixtures

For the purpose of this article, the last group may be classed as secondary stock foods, compounded from the primary stock foods of the othe three groups. Tables 1 and 2 list the majo primary foods available in Queensland and recen analysis results by officers of the Agricultura Chemist's Branch, or guaranteed analyses covering their principal nutritive value. In all case guaranteed analyses have been confirmed b recent analytical work.

TABLE 1

RESULTS OF ANALYSIS OF RECENT SAMPLES OF PLANT PRODUCTS WHICH MAY BE USED IN MANUFACTURE OF COMPOUNDED MIXTURES

Product	Moisture %	Crude Protein %	Crude Fat %	Crude Fibre %	Carbo-hydrates %	Ash %
Barley	9·3	12·4	2·1	4·7	68·3	3·2
Barley, Skinless	10·8	15·1	1·5	3·1	67·5	2·0
Bean, Brown Beauty	9·6	20·1	9·3	6·8	50·3	3·9
Bean, Hawkesbury Wonder ..	8·8	17·3	1·5	3·1	65·2	4·1
Bean, Broad	8·5	20·7	1·4	7·3	59·0	3·1
Canary Seed, Graded	7·2	15·6	5·7	5·5	59·9	6·1
Canary Seed, Ungraded	9·2	11·7	6·3	6·6	58·8	7·4
Canary Seed, Toowoomba (*Phalaris tuberosa*)	7·7	16·1	7·0	8·0	56·4	4·8
Clover	8·1	35·2	8·0	11·3	33·7	3·7
Cowpea, Cristaudo	10·0	24·3	1·8	4·2	55·6	4·1
Cowpea, Poona	8·6	21·2	1·2	4·8	60·4	3·8
Cowpea, Reeves	10·4	22·9	1·6	4·6	56·6	3·9
Coconut Meal	..	21·7	7·0	9·5	46·9	5·1
Coconut Meal (Key Meal)	..	22·2	6·3	11·0	..	..
Cottonseed Meal	..	41·3	..	..	..	..
Linseed	6·2	21·9	34·8	16·5	17·8	2·8
Linseed Oil Meal	8·0	37·3	4·6	6·5	38·7	4·1
Lucerne Seed	6·9	35·1	10·0	13·6	30·5	3·9
Lupins, Blue	5·5	29·7	5·3	15·9	41·0	2·6
Maize Meal	9·0	9·8	4·4	2·5	72·6	1·7
Millet, Japanese	10·0	11·5	9·2	5·1	59·8	4·4
Millet (*Setaria italica*)	8·5	12·8	3·0	8·5	64·2	3·0
Millet, White French	10·2	12·0	1·7	5·7	66·5	3·9
Millet, White Panicum	8·6	6·4	5·0	7·7	65·8	6·5
Oats, Algerian	7·2	7·7	6·1	10·6	64·5	3·9
Oats, Hulled	8·6	11·5	6·3	2·5	68·9	2·2
Pea, Field Dun	9·8	22·5	1·3	5·2	58·6	2·6
Pumpkin Seed Meal	5·2	27·7	28·0	31·6	4·6	2·9
Rape	4·9	22·1	40·3	6·3	22·3	4·1
Rye Corn	10·4	10·8	1·2	4·5	71·3	1·8
Safflower	7·4	12·6	24·0	29·2	24·6	2·2
Sorghum Meal	10·7	9·6	2·6	2·1	73·6	1·4
Sorghum, Broom Millet	10·0	10·1	2·8	5·1	68·3	3·7
Soy Bean	7·4	34·1	19·1	4·5	28·8	6·0
Sudan Grass Seed (Graded) ..	9·4	13·8	2·5	5·1	65·7	3·5
Sweet Sudan Grass Seed	9·2	6·9	3·6	8·4	67·4	4·5
Sunflower Seed	7·1	15·6	19·6	26·3	28·5	2·9
Tares	10·2	26·2	1·0	3·8	55·7	3·1

TABLE 2

ist of Primary Stock Foods Registered in Queensland Under “ The Agricultural Standards Act of 1952 ”

(For the period commencing January, 1959, as at 1st July, 1961)

Name of Preparation	Guaranteed Analysis			
	Min. Crude Protein	Min. Crude Fat	Min. Phos. Acid (P_2O_5) from bone	Min. Lime (CaO) from bone
	Per cent.	Per cent.	Per cent.	Per cent.
Animal By-Products				
Blood Meal				
nperial Dried Blood Meal (Sterilized)	80·0	..	..	..
lood Meal (Q.M.I.B.)	77·0	..	..	..
wift Blood Meal	75·0	..	..	..
ancbros. Blood Meal	75·0	4·0	..	..
inmore Dried Blood Meal	78·0	..	..	..
lood Meal (Warwick)	77·0	..	..	..
Bone Meal and Flour				
nperial Bone Meal (Sterilized)	12·5	..	26·0	32·0
ri-Cal-Os Sterilized Bone Flour	5·0	..	30·0	40·0
alphos (Q.M.I.B.)	20·0	..	25·0	30·0
'illiams Bone Meal	16·0	..	26·5	35·0
Liver Meal				
ndersons Liver Meal	66·0	17·5	..	..
nperial Liver Meal (Sterilized)	65·0	18·0	..	..
ver Meal (Q.M.I.B.)	65·0	12·0	..	..
viftgro Stabilized Liver Meal	65·0	12·0	..	..
vift Liver Meal	60·0	12·0	..	..
.M.E. Liver Meal	65·0	15·0	..	..
oma Liver Meal	66·0	17·5	..	..
Meat and Bone Meal				
ndersons Meat and Bone Meal	49·0	8·2	10·0	12·0
orthwicks Mebo Meal	52·0	10·0	8·0	9·6
R. Meat and Bone Meal	52·0	8·0	10·0	12·0
ahill Bros. Meat and Bone Meal	48·0	10·0	12·2	15·0
ortified Amagraze Protein Meal	50·0	8·0	10·25	12·0
nperial Fortified Protein Meal (Sterilized)	45·0	8·0	10·25	12·0
nperial Fortified Protein Meal (Sterilised)	50·0	8·0	10·25	12·0
aruda Meat and Bone Meal	54·0	13·5	7·0	8·0
arling Downs KR Meat and Bone Meal	50·0	13·5	6·5	8·0
inmore Meat and Bone Meal	50·0	11·0	11·0	14·0
uttons Meat and Bone Meal	50	8·0	12·0	16·0
eat and Bone Meal (Mangan)	45	10·0	10·0	12·0
olden Grove Meat and Bone Meal	45	10·0	12·0	17·0
akey Abattoir Meat and Bone Meal	45·0	9·5	10·5	9·0
TL Meat and Bone Meal	40·0	10·0	15·0	18·0
F. Meat and Bone Meal	42·0	10·0	15·0	18·0
otein Meal (Q.M.I.B.)	55·0	8·0	6·0	7·0
oma Meat and Bone Meal	49·0	8·2	10·0	12·0
nithfield Meat and Bone Meal	48·0	6·0	12·0	16·0
viftgro Stabilized Protein Meat Meal	55·0	10·0	..	..
vift Meat and Bone Meal	45·0	8·0	10·0	12·0
ncbros. Meat and Bone Meal	50·0	10·0	7·0	10·0
mbone Meat and Bone Meal	48·0	9·0	11·5	6·2
eat and Bone Meal (Townsville)	50·0	9·0	9·0	12·0
eat and Bone Meal (Warwick)	45·0	10·0	6·0	7·0
eat and Bone Meal (Bundaberg)	48·0	9·0	11·0	13·0
M.E. Fortified Meat and Bone Meal	50·0	8·0	10·25	12·0

TABLE 2—*continued*

List of Primary Stock Foods Registered in Queensland Under “ The Agricultural Standards Act of 1952 ”—*continued*

(For the period commencing January, 1959, as at 1st July, 1961)—*continued*

Name of Preparation	Guaranteed Analysis			
	Min. Crude Protein	Min. Crude Fat	Min. Lactose and Lactic Acid	Mineral Salts
	Per cent.	Per cent.	Per cent.	Per cent
Milk Products				
“ Unity ” Buttermilk Powder	30·0	9·0	38·0	8·0
“ Unity ” Whey Powder	11·0	0·5	68·0	8·0
“ Glenrock ” Buttermilk Powder	30·0	9·0	38·0	8·0
“ Amity ” Roller Dried Buttermilk Powder	30·0	9·0	38·0	7·0
Cow’s Head Milk Powder	20·0	20·0	..	..
“ Jacaranda ” P.D.B. Dried Buttermilk Powder	26·0	4·0	..	..
Kingston Buttermilk Powder Roller Dried	28·0	11·0	..	..
Kingston Skim Milk Powder	35·0	1·0	..	..
P.C.D. Buttermilk Powder (Gladstone)	26·0	4·0	..	..
S.B.D. Buttermilk Powder	25·0	10	..	..
S.C.D. Roller Dried Skim Milk Powder (Southport)	34·0	0·8	..	..
Skimmed Milk Powder (Casino)	34·0	0·5	..	..
Skimmed Milk Powder (Manning River)	34·0	0·5	..	..
Unity Skim Milk Powder	35·0	0·8	50·0	8·0

Name of Preparation	Guaranteed Analysis		
	Min. Crude Protein	Min. Crude Fat	Max. Crude Fibre
	Per cent.	Per cent.	Per cent
Plant Products			
Barley Meal			
Red Comb Barley Meal	10·0	2·0	6·3
Barley Meal (State Produce Agency)	11·0	1·0	6·0
Gillespie Barley Meal	9·0	1·8	5·5
Parklands Barley Meal	11·0	1·0	6·5
Sauers Barley Meal	11·0	1·0	6·0
Coconut Meal			
Cerevite Coco Meal	21·0	6·0	11·0
C.P.L. Brand Copra Expeller Oil Cake	20·0	5·0	12·0
Key Meal (Lever)	20·0	5·0	8·5
Cottonseed Meal			
“ Bacal ” Cottonseed Meal	40·0	5·0	15·0
C.M.B. No. 2 Cottonseed Meal	35·0	5·0	20·0
Linseed Oil Meal			
Meggitt’s Linseed Oil Meal	35·0	3·5	10·0
Lucerne Meal			
Zischke’s Lucerne Meal	15·0	1·9	30·0
Maize Meal			
Athmaze Maize Meal	9·0	4·0	4·0
“ Lamberts ” Maize Meal	10·0	5·0	5·0
Maize Meal (Patterson)	9·5	3·5	5·0
“ Red Comb ” Maize Meal	10·0	3·5	3·5
Maize Meal (Sauer)	10·0	3·5	5·0
Maize Meal (State Produce)	9·5	3·5	3·0
Gillespie Maize Meal	9·0	4·0	3·0
Gympie Co-operative Maize Meal	10·0	3·5	5·0
Yarraman Maize Meal	9·5	3·5	4·0
Peanut Meal			
“ Bacal ” Peanut Meal	40·0	7·0	10·0

TABLE 2—*continued*

LIST OF PRIMARY STOCK FOODS REGISTERED IN QUEENSLAND UNDER "THE AGRICULTURAL STANDARDS ACT OF 1952"—*continued*

(For the period commencing January, 1959, as at 1st July, 1961)—*continued*

Name of Preparation	Guaranteed Analysis		
	Min. Crude Protein	Min. Crude Fat	Max. Crude Fibre
	Per cent.	Per cent.	Per cent.
Sunflower Meal			
"Bacal" Sunflower Meal	30·0	10·0	15·0
Sorghum Meal			
Bona Vista Milo Meal	9·5	2·0	3·0
"Lambert's" Sorghum Meal	10·0	2·0	2·5
Gillespie Sorghum Meal	8·5	2·0	2·5
Sorghum Meal (Patterson)	9·5	2·5	3·0
"Red Comb" Sorghum Meal	10·0	2·5	2·5
Sorghum Meal (Sauer)	10·0	2·0	3·0
S.P.A. Sorghum Meal	10·0	2·2	2·3
Sorghum Meal (Jonsson)	10·0	2·5	2·5
Gympie Co-operative Sorghum Meal	10·0	2·5	2·5
Wheat Meal			
"Lamberts" Wheat Meal	12·0	1·5	5·0
Wheatmeal (Maleny Co-operative)	10·0	1·1	3·5
"Red Comb" Wheat Meal	10·2	1·5	3·5
Wheat Meal (Patterson)	12·0	1·5	5·0

Name of Preparation	Guaranteed Analysis		
	Minimum Crude Protein	Minimum Crude Fat	Maximum Crude Fibre
	Per cent.	Per cent.	Per cent.
Crushed Wheat (State Wheat Board)	14·7	1·0	4·0
"S.P.A." Wheat Meal	12·0	1·5	5·0
WHEAT BY-PRODUCTS			
Bran (BCC)	14·0	2·0	11·0
Bran (Barnes)	15·5	3·0	9·0
Bran (Dalby)	16·0	2·5	11·0
Bran (Defiance)	15·0	2·0	11·0
Bran (Gillespie)	14·0	2·5	12·0
Bran (Red Comb)	14·5	2·5	11·0
Bran (Q.C.M.A.)	14·7	2·6	11·0
Bran (Warwick)	15·5	2·5	11·0
Pollard (Barnes)	14·3	3·2	7·0
Pollard (Dalby)	16·5	3·5	7·0
Pollard (Defiance)	15·0	3·0	7·0
Pollard (Gillespie)	14·3	3·2	7·0
Pollard (Red Comb)	14·0	3·0	7·0
Pollard (Q.C.M.A.)	15·0	2·5	10·0
Pollard (Warwick)	15·5	3·5	7·0
Pollard (BCC)	15·0	3·0	7·0

PRIMARY STOCK FOODS

The preparation and manufacturing processes of the primary stock foods are diverse. The following gives but a brief outline of the origin and preparation or manufacture of those used in the compounding of prepared stock foods.

(1) Plant Products

Grains may be fed whole or as a meal, reduction to a meal being carried out by grinding grain in a plate grinder or a hammer mill. Particle size is variable, but medium size is preferable to a fine powder.

Lucerne. Whereas oaten or wheaten hay or chaff is invariably fed as such direct to animals, lucerne hay or chaff also finds frequent use in prepared stock foods, such as poultry mashes, because of its normally relatively high protein content, particularly in freshly cut leafy lucerne which may contain an average of 15 to 16 per cent. crude protein.

Lucerne hay or chaff must be reduced in size by treating the plant parts in a hammer mill.

Wheat Products consisting of bran, pollard and wheat germ meal are by-products of flour manufacture.

Flour milling consists essentially of passing wheat specially prepared by cleaning, moistening and so on, between many sets of fluted rollers each set spaced closer together than the previous. Spacings range from slightly smaller than the wheat grain to the final set producing the particle size of flour. Thus the wheat grain is broken up into approximately 68 per cent. flour, 2 per cent. wheat germ, and the remainder into the mill offals, bran and pollard.

Bran is the coarse outer coat of the wheat grain which is removed after passage through the first few rollers, whence it is separated, cleaned and packed. It is defined in the Agricultural Standards (Stock Foods) Regulations:

> "Bran shall consist of the outer skin or coating of the wheat grain or berry, pure and without admixture of any kind, obtained in the usual commercial milling process from wheat from which there shall have been removed all impurities by cleaning and scouring. Whole or broken grain shall be absent."

As the wheat continues through the milling process, particle size becomes progressively smaller, and the intermediate sizes or middlings are classed as *Pollard*. These intermediate particles consist of smaller bran pieces, wheat germ pieces and large flour pieces. The Regulations applying to pollard provide that 99 per cent. shall pass through a B.S. 12 sieve (1/18 in. square aperture). The symbol B.S. in this text means British Standards Institution.

Wheat Germs are the wheat grain embryos which are freed during milling and are screened off from the pollard and form wheat germ meal. They are a source of manganese.

Chaff, which is hay or straw cut into short lengths, must not contain more than 12 per cent. moisture, 10 per cent. chaff of other varieties, and 5 per cent. of other material.

Maize Germ Meal and Maize Gluten Meal are by-products of starch manufacture.

Malt Sprouts are the sprouts rubbed off dried germinated barley in the process of converting it to malt.

Straw, Screenings and Clipped Oat Refuse are remnants of various processes.

Dried Brewers Grains are the dried residue of grains used in the manufacture of beer.

These last four stock foods are not used to any extent in the compounding of secondary stock foods in Queensland.

Oil-bearing Seeds, such as linseed, cottonseed, sunflower seed, safflower seed, peanut seed and soybean and also coconut flesh are valuable for their oil content and this is usually obtained by a process called expression. This consists of pressing the seed or seed flesh by mechanical or hydraulic means at pressures up to 5,000 lb. per sq. inch with heat, thus squeezing out the oil. The seeds must first be cleaned of impurities, and in the case of cottonseed, this must also be delinted. The pressed seed residue or cake usually retains a quantity of the oil, varying with the efficiency of the process and of the plant and operators. It is these residues that are used in prepared stock foods as valuable protein supplements as well as being very palatable when fresh and slightly laxative in their effect. The oil content is determined as "crude fat" along with the ether soluble extracts of the stock food with which it is mixed.

An alternative method for extracting oil from plant products is the solvent extraction process, not generally employed in Queensland. In actual fact, this method is more efficient in extracting the oil content than the pressure method. Oil in residues after solvent extraction can be reduced to less than 1 per cent. compared with as much as 6 per cent. and more in mechanically pressed residues. The solvent process is particularly advantageous in the processing of seeds of low oil content and for oil of a high commercial value. The resultant seed cake from this process is not so valuable for stock feed as that obtained by other means because of the lower oil (fat) content.

Molasses is a by-product of the sugar industry. It is the thick syrupy liquid remaining after brown sugar has been crystallised out from the concentrated sugar cane juice. It contains a proportion of various sugars.

Molasses is used mainly as an appetiser to coax animals to eat the food, but it is also a scource of carbohydrates. The nitrogen contained in molasses is present in very small quantities and in the form of compounds having little nutritive value. These nitrogenous compounds are therefore regarded as having no protein value. Moisture content must be controlled because excessive water in molasses, particularly in warmer climates, encourages fermentation (a process whereby enzymes in the molasses act on the sugars, breaking them down to alcohol). Maximum moisture allowed under the regulations is 28 per cent.

(2) Animal Products

Meat Meal and Meat and Bone Meal are prepared by either wet or dry rendering of animal tissue from animals which, having been slaughtered for human consumption are free from harmful disease.

The wet rendering consists of digesting (cooking) the tissue and offal in closed tanks into which steam is injected under pressure. The dry rendering consists of digesting the same material in open, jacketed, steam heated tanks. The essential difference is that steam contacts the animal tissue in the wet rendering process, while in the dry rendering process this does not occur. It is claimed that meal produced by dry rendering produces higher quality protein than that produced by wet rendering. Pressures and times varying from one plant to another, and for the different processes, are usually chosen by experiment and lie between 40 to 90 lb. to the square inch, the time of cooking being from 3 to 6 hours. In any case, the Stock Food Regulations require sterilization for a minimum of 3 hours at 250 deg. F.

After digestion, the liquid and fat produced are removed by straining and by means of a centrifuge or by pressing, and the residue dried and ground to such a size that all passes through a B.S. 7 (1/10 in.) sieve. In accordance with the regulations, only those meals containing less than 5 per cent. phosphoric acid (P_2O_5) may be classed as meat meals, meals containing more than 5 per cent. phosphoric acid being prescribed as meat-and-bone meals.

A desirable limit should be placed on the fat content of the meal as this can be the cause of a number of troubles. Too high a content tends to make the meal go rancid prematurely. It may cause trouble in the mixing process, particularly in a continuous system, by forming into lumps and impeding or actually stopping the flow of meal into the mash being manufactured. Although the regulations do not at present prescribe a maximum figure, 10 to 12 per cent. fat is considered a satisfactory maximum.

Also, bone content of a meat-and-bone meal should not be excessive, as protein available from this source is not of high quality and is not easily digestible by animals. Sufficient only to supply the required calcium and phosphorus should be included. In addition, particle size of bone is important. Too large a particle is undesirable, as it would not be readily assimilated, and furthermore, splinters could lodge in the throat or other parts of the digestive system, particularly of poultry, causing injury and possibly death. The regulations provide that all must pass through a B.S.7 (1/10 in.) sieve.

The protein available from blood meal is also of a relatively low digestibility, excessive quantities may cause digestive problems, particularly in young stock, and for these reasons, protein content of a meat meal or a meat-and-bone meal should not be built up with large quantities of blood meal.

Liver Meal consists of animal livers which are dry-rendered, sterilized and ground.

Blood Meal is made by first coagulating whole animal blood by live steam, draining off excess moisture, sterilization, drying to a moisture content of 10 per cent. or less, then grinding to required particle size either to form meal or flour.

Bone flour is prepared from animal bones, these being digested with steam under pressure. After the meat and fat are removed, the material is sterilized and ground to a size permitting all of it to pass through a B.S.16 (1/25 in.) sieve and 70 per cent. of it to pass through a B.S.60 (1/100 in.) sieve. A coarser variety *bone meal* must all pass through a B.S.12 (1/18 in.) sieve. *Bone char,* sometimes used for feeding, is produced by "burning" bones in retorts and grinding the product small enough to enable all to pass through a B.S.12 (1/18 in.) sieve.

Other lesser animal by-products for which standards are provided in the regulations are listed:

Kibbled bone, bone cree and bone green are prepared from fresh animal bones and sterilized for two hours at 212 deg F.

Organic meal is prepared from ground animal organs sterilized for a minimum of 3 hours at 250 deg. and having a maximum phosphoric acid content of 1 per cent.

Milk Products

Milk products consist of wholemilk, buttermilk (the watery substance remaining after butter has been removed from the churn: somewhat akin in composition to skim-milk) and whey (the liquid remaining in the cheese vat after the curd has been removed). All three are prepared in powder form either by roller drying or by spray drying.

In the case of roller drying, the liquid is piped to pairs of steam-heated revolving drums. These slowly revolve and carry a thin film of the milk product which is soon dried by the heat and removed from the drum by knives for bagging.

The spray drying process consists of injecting the liquid milk product into a superheated stream of high velocity air directed into a large inverted collecting cone. The liquid stream is quickly "atomised" and the water evaporated, the solid particles falling to the bottom where they are collected.

Fish Products

The principal fish products are the oils and these are usually obtained by expression. They are valuable for their vitamin content.

Fish meal and fish and bone meal are the ground residues of fish, all being required to pass through a B.S.7 (1/10 in.) sieve. The regulations prescribe that in the case of Fish Meal, the maximum prosphoric acid content shall be 10 per cent. while this is the minimum figure prescribed for fish and bone meal.

White Fish Meal is dried ground waste of white fish which in acordance with the regulations must contain no more than 6 per cent. oil and 4 per cent. salt. At present there are no fish meals registered for sale in Queensland.

Whale Meat is another source of protein. It is the ground residue remaining after the oil has been pressed from the flesh of freshly killed whales.

Two grades are provided for in the regulations. Whale meat meal must not contain more than 5 per cent. phosphoric acid but whale meal may contain larger quantities of bone with a consequent phosphoric acid content in excess of 5 per cent. In both instances, particle size must be such that will permit all to pass a B.S.7 (1/10 in.) sieve. These grades correspond to meat meal and meat and bone meal.

(3) MISCELLANEOUS PRODUCTS

Urea. Although up to the present not used to any extent in Queensland, this material may be employed as a stock food. The nitrogen content (averaging 46 per cent.) can be converted into protein by ruminants and is therefore a source of this essential nutrient.

It is manufactured synthetically, using nitrogen of the air.

Excessive quantities are poisonous to animals and care must be exercised when urea is used to boost the protein content of low-protein feeds.

Minerals are used for supplying common necessary elements and also in mineral supplements (including licks) for supplying trace elements where such are known to be deficient. The principal added minerals are as follows:

(1) *Salt* is usually ground to size from naturally occurring rock salt, or recovered from sea water, or sometimes refined commercial grades are used.

(2) *Oyster* and *Clam shells,* a source of calcium, consist of the individual items ground to suitable size.

(3) *Limestone* consists of limestone, marble, coral or other material consisting chiefly of lime in the form of calcium carbonate ($CaCO_3$) ground to pass a B.S.30 (1/50 in.) sieve.

(4) *Manganese* as manganese sulphate to prevent perosis (slipped tendon) in chickens.

Mineral Supplements usually consist of a base of salt (the most common mineral), bran, molasses and so on, mixed with metallic salts of the required element or elements, used either as a meal or compressed into a block. These supplements are used as additional feeds.

On the other hand, trace element additives are incorporated into the basic stock foods during the mixing process.

The elements required are obtained from their metallic salts of British Pharmacopoeia or equivalent standards.

Vitamins are essential for various bodily functions. The most important for farm animals are A, B_2 and D_3. Vitamin A is essential for normal growth and vision, while vitamin B_2 (riboflavin) is necessary for animal growth and hatchability of eggs. Vitamin D_3 regulates absorption and use of calcium and phosphorus in bone structure. The vitamins used as additives in prepared stock foods are made synthetically or are derived from natural sources such as fish oils and so on. Vitamins occur in some of the primary stock foods (for example B_2 in liver meat, wheat germ, etc.).

Measurement is by the international unit, which refers to the potency or activity of the vitamin. This quantity varies according to the vitamin and is usually measured in micrograms.

Antibiotics are substances produced by micro-organisms that inhibit growth of, or kill, bacteria or higher fungi. Only a few are effective in protecting animals against pathogenic micro-organisms. The antibiotics used for inclusion in stock foods are derived from the following organism groups:

1. Aerobic (spore-forming bacteria);
2. Actinomycetes;
3. Filamentous fungi.

The Antibiotic bacitracin belongs to group 1, which are bacteria occurring naturally in the soil. Bacitracin is produced by the growth of the organism *bacillus*. Group 2 are the soil organisms occurring in particularly large numbers in decaying vegetable matter. The antibiotic aureomycin is the hydrochloride of a mixture of substances produced by the growth of *Streptomyces aureofaciens*, bacteria of group 2. It is relatively non-toxic.

The antibiotic penicillin is produced by the organisms of group 3, being a product of several common "moulds" of the species of fungi *Penicillium*.

Antibiotics are measured in international units, a quantity which varies with the particular antibiotic.

Appetisers are used to tempt animals to eat a stock food which may otherwise be unattractive. They are mostly used in mineral supplements. Aniseed and molasses are the most common. Aniseed is a strong-flavoured oil obtained from the plant *Pimpinella anisum*.

SECONDARY STOCK FOODS

As already indicated, Tables 1 and 2 set out the principal chemical values of stock foods regarded in this article as primary stock foods, and a general description of them has been given. These foods play a large part in the feeding of stock, not so much by being fed alone but by being fed in combination with one another in varying proportions according to their chemical and other properties. They then form secondary products of any desired chemical analysis or food value, so important in providing a balanced ration.

It should be obvious that nutritional requirements will vary for different types of animals and earlier in the article it was indicated that food requirements would vary with the age of the animal or bird and phase of productiveness through which it is passing. For example, a dairy cow in milk would require a greater intake of food than would be the case with a dry animal; chicken growing and laying mashes contain different protein levels to meet the varying requirements of the hen in its different stages of life.

Furthermore, overcoming deficiencies in vitamins or minerals may be all-important in the nutritional requirements of the various groups of stock. All these specific requirements may be met by the judicious blending of primary ingredients to produce the food required. Certain standards are prescribed in the regulations for various types of compounded foods and these standards can be maintained only by a manufacturer with a full knowledge of the chemical composition of the ingredients he has available.

It can be appreciated, therefore, that the manufacture of these prepared foods, covering the accurate blending of the selected components, particularly those used in minute quantities, is no simple task, and to produce a product that will give a uniform chemical composition throughout calls for a thorough knowledge of the chemical constituents of ingredients, efficient machines and skill on the part of the operators who control them.

MANUFACTURE OF STOCK FOODS

The equipment used to prepare compounded mixtures falls into two broad classes—batch mixers and continuous mixers.

In Queensland, the manufacture of prepared stock foods is of considerable importance when we consider that over 500 prepared stock foods are registered and it is estimated that over 1,500,000 bags are produced annually. Ideally each manufacturing plant should have available the services of a chemist, who is able to check on the mixing by continuous chemical analysis of samples of the food during manufacture, and on the quality of the primary ingredients.

The major proportion of the State's output is under such a control, but to the smaller producer the cost of employment of a chemist would be prohibitive. In these cases representative samples should be submitted at regular intervals for analysis by one of the commercial analysts carrying out this work in Brisbane. Furthermore, constant checks by Standards Branch Inspectors ensure that formulae and standards prescribed under the regulations are maintained.

Batch Mixing

Batch mixing is practised by several small manufacturers who have neither the output nor the capital to warrant the use of mechanical plant. This method consists of placing the weighed quantity of each of the component parts (in accordance with the formulae) on a clean floor or inside a large half tank. Measurement should be by weight. It is unwise to measure by volume, as this is invariably inaccurate, resulting in deficiencies in the final product. The usual procedure is to incorporate items so that the total quantity of any one item is not placed in the one layer, thus facilitating mixing.

When adding vitamins and antibiotics and other components in small quantities, it is usual to premix these items with a quantity of one of the other suitable constituents to ensure more even distribution throughout the mix.

The components are then thoroughly turned with a shovel until a homogeneous mixture is obtained, that is, samples taken from various parts of the heap would show similar analyses.

With this method, it is usual to mix the grains whole and after turning with the shovel, the batch is fed through a hammer mill or grinder, thus allowing for further mixing while the grains are being crushed to a meal. As the food is delivered from the mill it is bagged, weighed and labelled ready for sale.

If the mixing is thorough, this method is able to produce a very uniform product and this is confirmed by subsequent analysis of official samples. In those cases where deficiencies occur they are generally of a very minor nature and many factors other than mixing could influence this position (such as incorrect weighing and use of sub-standard primary components).

Mechanical Mixing. Two types of mechanical mixer are used—the horizontal and the vertical. The horizontal consists essentially of a rectangular container with one rounded side. This side forms the base and adjacent to it on the inside are placed the agitators. Provision is made for a filler opening in the top and the outlet is placed at one end on the bottom. The agitator is usually designed to move the material forward toward the outlet as mixing progresses. These units are usually used in conjunction with a hammer mill or grinder for grain reduction, and are suitable for medium output manufacturers having capacities ranging from 3 to 36 or even more bags per batch.

The component parts of the food batch are weighed out and put into the mixer, the grains having been ground previously. The agitator is started with the outlet closed and allowed to run until the components are thoroughly mixed. The outlet is then opened and the stock food is bagged off, weighed, sewn and labelled, until the mixer is empty; it is then ready for the next batch.

The vertical batch mixer (or fountain mixer) usually has a greater capacity, as much as 100 bags per batch, and is suitable for the manufacturer with a higher output. The design lends itself well to two-floor operation, in addition to taking up less floor space.

The mixer comprises a cylinder with a cone outlet at the base, provided with an inspection door. Inside is a central vertical worm agitator.

The mixer is charged at the top with the weighed primary components in layers. This is usually done on the upper floor. The mixer is then started and the worm draws the proportioned components in and up, thoroughly mixing in a circular motion in about 15 min. After this time, the food is drawn off from the apex of the cone on the lower floor.

Where more than one vertical mixer is in use, continuous manufacture is possible, one unit loading and mixing while another is being drawn on for supply.

The advantage of batch mixing is that after each batch the mixers are automatically almost completely cleaned out (particularly the vertical mixer) and this simplifies changing from one formula to another.

The Continuous Mixer

The continuous mixer system cuts labour costs considerably and lends itself to high output. On the other hand, greater attention is required during operation as there are many sections in the processing machinery where delays or blockages are likely to occur which would alter the formula of the stock food being manufactured. Layout varies considerably but the basic units comprising the system are similar, consisting of storage bins, feeders, conveyors, elevators, hoppers and weighing and bagging arrangements.

The primary stock food supplies are stored in bins, sometimes on the floor above the mixing plant. Grains and chaff are usually reduced prior to storage. These bins are topped up as required. From the base of each bin an outlet connects to an automatic feeder. This consists of a compartment in which is located a rotor, which is turned by a ratchet and pawl driven from a shaft running the length of the bins. The revolutions of the rotor, and hence the amount of meal it passes, are determined by the throw of the pawl which in turn is governed by the radius of the point of connection of the connecting rod to the driving wheel. The larger the radius the faster the material is drawn from the bin. The setting is variable from small quantities to the large deliveries required for the more common primary foods, such as bran and pollard. Constant attention is required to ensure the material does not block at this point. Should this happen the supply of that particular component would be cut off, the formula upset, and consequently analysis would not comply with that guaranteed.

Trace elements and similar materials are fed from a special feeder capable of much finer adjustment to suit the minute quantities needed.

The measured amount of each component is fed to a screw conveyor and is carried via a bucket elevator to the supply hopper. Mixing occurs during passage along the conveyor. The food may be put through a batch mixer at this point to help mixing. From the hopper the stock food is drawn off into bags, and in the complete continuous process is automatically weighed and machine-sewn and labelled.

When changing to a different formula, the continuous plant is at a disadvantage. Although changing of the pawl setting is all that is required as far as the formula is concerned, if conveyors and elevator boots are not cleaned thoroughly, the contents of the first bags of the new batch will have an incorrect formula.

Pelleting

Of late, a trend has developed towards the use of pelleted foods. Among advantages claimed are less wastage and consumption of complete ration.

Pelleting consists of compressing the particles of a mash into semi-solid pieces varying in size according to the use of the food. Chick pellets for instance, are small cylinders approximately one thirty-second in. in diameter by three-eighths in. long, while sheep cubes may be about half inch square.

Two methods of manufacture consist of:

(1) Injecting a binder such as molasses, heating, and compressing by the extrusion process,

(2) Injecting live steam and compressing, using the starch of the grain ingredients as a sticker.

The pelleting machine consists of a feeder, a mixer and the pelleter.

The feeder, which regulates the flow c material, works on the ratchet principle an governs the output of the machine. The mea then passes to the mixer, where it is agitate to ensure uniform mix, and at the same tim preheated molasses or steam is injected. Th meal is then carried to the pelleter, consisting c a cylindrical pellet die (interchangeable for different sized pellets) whose circumference i perforated with many holes the diameter of th intended pellet.

To save the time involved in changing die when different sizes of the same mixture ar required, the practice has developed whereby th larger pellets are partially crushed to a suitabl size. These are known as "crumbles."

The treated meal is fed to the inside of th revolving die and is pressed out through th holes by rollers bearing against the inside of th dies. Knives set around the outside of the di cut the pellets to the desired length.

The pellets are then allowed to cool befor bagging to prevent sweating and consequen mould growth.

Pelleting machines may be operated in conjunction with batch or continuous plants.

MIXING OF LIQUID PRIMARY STOC FOODS

When liquids are introduced into stock foods an even distribution is difficult to obtai Thorough premixing with a small quantity of th meal and subsequent thorough distributio throughout the bulk may suffice with the light oil such as fish oils, but with viscous liquids such a molasses the tendency is to form concentrate balls which are difficult to incorporate in th bulk. It has been found that the most satisfactory method is to preheat the molasses an inject it into the agitated meal in a semi-atomise state with a jet of high pressure steam (as i some pelleters). The fine molasses particles ar thus more evenly distributed throughout the stoc food.

Hammer or Impact Mills and Grinders

These are used for reducing grain, hay or chaf to meal for use in stock food. Basically, th hammer mill consists of a high speed shaft rotatin in a chamber. On the shaft are beaters o hammers which break the material upon impac until it is small enough to pass through the selecte erforated screen forming the circumference of the hamber. Capacities range from approximately 00 lb. to 25 cwt. an hour.

Plate grinders are used to a lesser degree, mostly the smaller manufacturers, for the same purposes. Construction consists of sets of plates aced according to required meal size. Plates e alternately rotating and stationery, causing a inding action to the material passing along the ace between the plates.

Weighing of stock food into bags by the automatic weigher is carried out in some plants. The ag is placed over a cylinder down which the meal fed until the required weight has been delivered the bag. The weigher then automatically shuts elf off.

Sewing. The bag sewing machine used in some ants cuts bag closing time very considerably. It ws across the top of the bag with a large achine stitch, sewing on the label in the process. ome manufacturers use hand sewing methods.

Bag Marking. Two methods are employed r marking bags—printing and stencilling. The rmer, suitable for large manufacturers, uses a g printing machine, working on the same lines a paper printing press, while stencilling is suited the small manufacturer, being cheap, quick and fective.

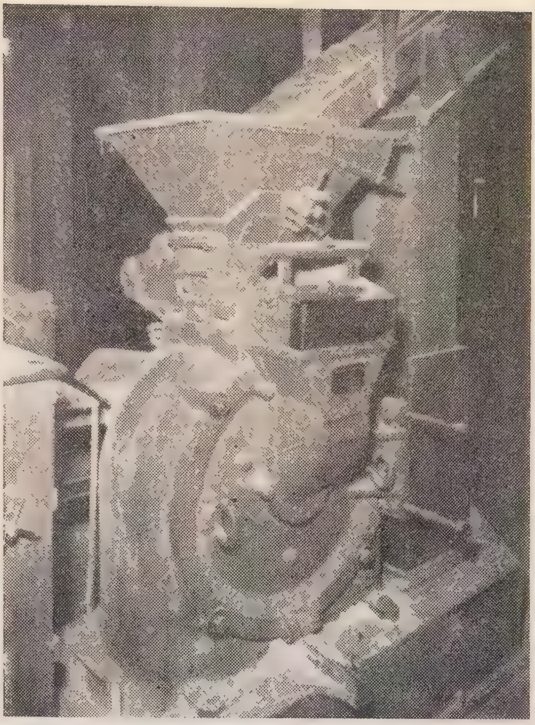


Plate 2

A High Capacity Hammer Mill.

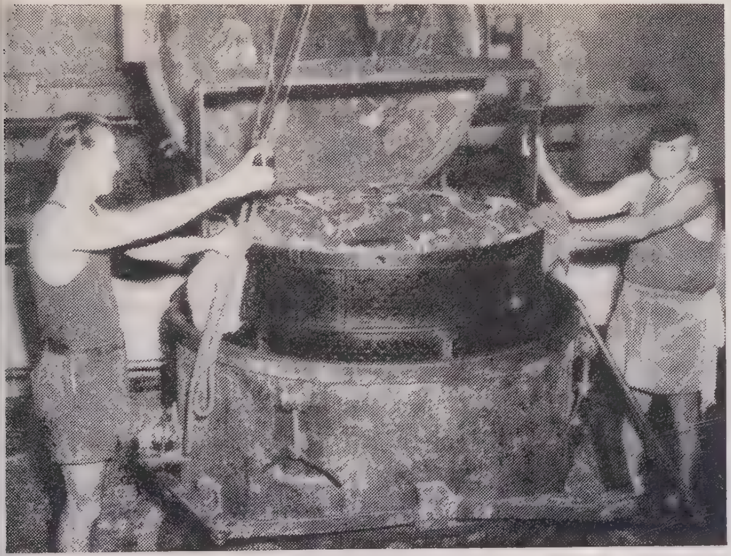


Plate 3

Loading Meat and Bone into a Centrifuge for Fat Extraction.

Laboratory. To allow full control over manufacturing processes, the laboratory should be equipped to carry out determinations for total nitrogen (for the estimation of crude protein), crude fat and crude fibre. In addition, the ability to determine phosphorus, calcium, and salt would also be advantageous.

Standards of Quality

The agricultural Standards Act of 1952 provides legislative authority to control the sale of many types of agricultural requirements, which include stock foods. Standards of nutritive value for a wide range of primary and secondary stock foods are prescribed in the regulations under the Acts, copies of which are available on request to the Standards Officer, Standards Branch, Department of Agriculture and Stock.

Registration Requirements

To protect the purchaser and to be sure that the guaranteed chemical analysis, and where applicable, standards, are complied with, each primary dealer, who must be resident in Queensland, must apply to the Standards Officer for registration of his stock foods before placing them on the market. Specific details as to registration and labelling requirements are set out in Appendix A. In general, registration involves the submission of the complete formula for each stock food, including the constituents, and the percentage of constituents used. This is carefully scrutinised to ensure that a satisfactory food may result.

Each prepared stock food package must be labelled, showing, among other things, the distinctive name of the stock food, a list of the ingredients and the guaranteed chemical analysis, so that the buyer shall know something about his purchase, and enable him if he so desires, to make a comparision of the different brands of that stock food.

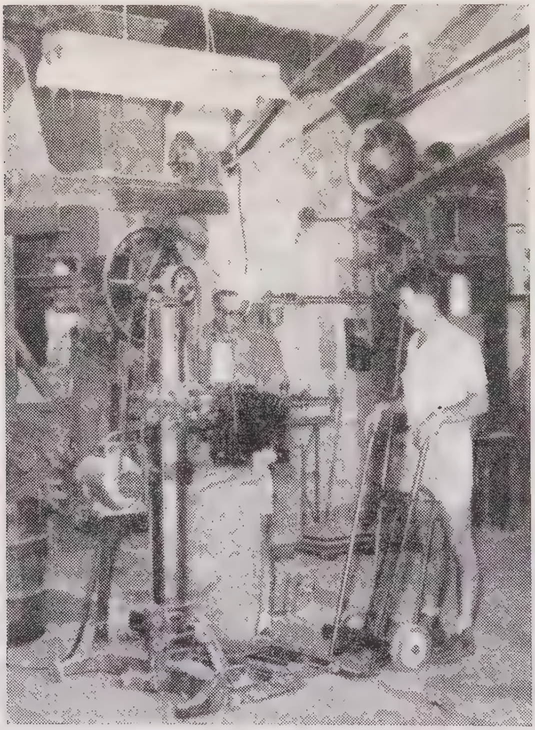


Plate 4

Bagging, Weighing and Sewing Operations.

Where the label is likely to become detache the provisions of the Act require that the co tainer should be marked with the name of t stock food to preserve the identity of the materi

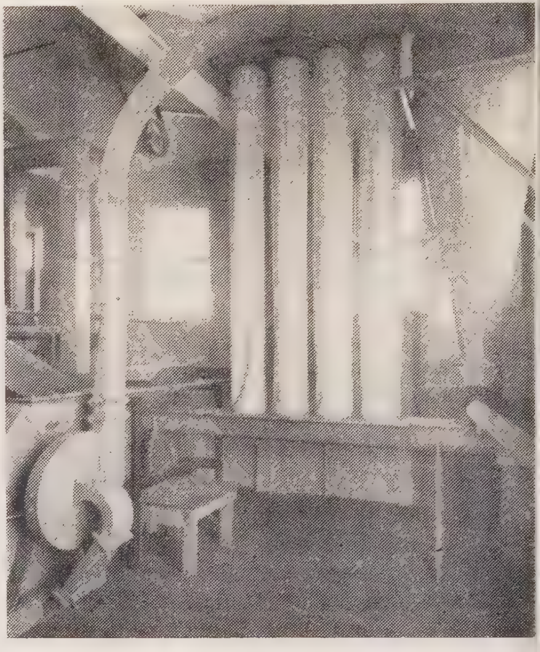


Plate 5

Hammer Mill, Blower, and Cyclone for Grain Meal Production.

Compilation of Label

Although analysis of a sample is the only su manner of ascertaining the chemical properti of a prepared stock food, it is possible to calcula from the formula an approximate analysis of material. To do this, it is of course necessary t know the chemical analysis or nutritive value o the various ingredients. Tables 1 and 2 provid this information. When calculating an approx mate analysis, due allowance should be made fo variations, particularly of plant products, whic are by no means consistent and may be influence by many factors, chief of which are season conditions, cultural methods, and locality of pro duction. Where a guarantee figure is given o the label for a prepared primary stock food suc as a meat and bone meal, due allowance ha already been made for slight variation Standardised chemical analysis figures for som plant products are given in Table 3.

TABLE 3

AVERAGE COMPOSITION OF PRIMARY STOCK FOODS FOR COMPILATION OF FORMULAE

Name of Preparation	Minimum Crude Protein	Minimum Crude Fat	Maximum Crude Fibre
	Per cent.	Per cent.	Per cent.
Wheatmeal	12·0	1·5	5·0
Maizemeal	9·0	5·0	5·0
Oatmeal	9·5	4·5	12·0
Barleymeal	11·0	1·0	6·0
Sorghum-meal	10·0	2·5	2·5
Bran	14·0	2·0	11·0
Pollard	15·0	3·0	7·0
Lucernemeal (choice) ..	15·0	1·9	30·0
Lucernemeal (stemmy) ..	12·4	1·5	35·9
Pea Meal	20·0	1·0	6·0
Wheat Germ Meal	27·0	10·0	2·0
Millet	10·0	4·5	8·5

When compiling a formula in this manner, the following example sets out the precedure with respect to a batch of 100 lb. of the mixture.

It will be seen that the general calculation formula is: $\frac{a \times b}{100} = c$, where

a = amount of primary stock food ingredient to be included in the formula.

b = percentage of crude protein, crude fat, crude fibre, &c., contained in the primary ingredients as shown in Tables 1, 2, and 3.

c = amount of crude protein, crude fat, &c., available from each primary stock food contained in the formula.

TABLE 4

EXAMPLE OF A CALCULATED FORMULA FOR A RECOMMENDED PREPARED CHICKEN MASH WHERE AN 18 PER CENT. CRUDE PROTEIN AND A MAXIMUM CRUDE FIBRE CONTENT OF 4·5 PER CENT. IS REQUIRED

Primary Stock Food	lb. in Formula	Calculation of Protein %	Calculation of Fat %	Calculation of Fibre %	Calculation of Lime (CaO) %	Calculation of Phos. Acid P_2O_5 %
Sorghum Meal	26	$\frac{26 \times 10}{100} = 2{\cdot}60$	$\frac{26 \times 2{\cdot}5}{100} = 0{\cdot}65$	$\frac{26 \times 2{\cdot}5}{100} = 0{\cdot}65$	..	..
Maize Meal	24	$\frac{24 \times 9}{100} = 2{\cdot}16$	$\frac{24 \times 5{\cdot}0}{100} = 1{\cdot}20$	$\frac{24 \times 5}{100} = 1{\cdot}20$	..	..
Barley Meal	25	$\frac{25 \times 11}{100} = 2{\cdot}75$	$\frac{25 \times 1}{100} = 0{\cdot}25$	$\frac{25 \times 6}{100} = 1{\cdot}50$	..	..
Lucerne Meal	3	$\frac{3 \times 15}{100} = 0{\cdot}45$	$\frac{3 \times 1{\cdot}9}{100} = 0{\cdot}05$	$\frac{3 \times 30}{100} = 0{\cdot}90$	..	..
Buttermilk Powder (30%) ..	5	$\frac{5 \times 30}{100} = 1{\cdot}50$	$\frac{5 \times 9}{100} = 0{\cdot}45$	..	..	..
Meatmeal (55%)	$10\frac{1}{2}$	$\frac{21 \times 55}{2 \times 100} = 5{\cdot}77$	$\frac{21 \times 8}{2 \times 100} = 0{\cdot}84$	..	$\frac{21 \times 7}{2 \times 100} = 0{\cdot}7$	$\frac{21 \times 6}{2 \times 100} = 0{\cdot}6$
Livermeal (65%)	5	$\frac{5 \times 65}{100} = 3{\cdot}25$	$\frac{5 \times 12}{100} = 0{\cdot}60$	..	..	..
Pulverised Limestone ..	1	..	..	..	$\frac{1 \times 50}{100} = 0{\cdot}5$	..
Salt Premix including Manganese sulphate and Riboflavin)	$\frac{1}{2}$	..	..	..	..	..
Vitamin A and D_3 Supplement	as per directions					
	100	18·48	4·04	4·25	1·2	0·6
Rounded off	..	18·0	4·0	4·5	1·2	0·6

Prohibited Material

The regulations prescribe certain weeds of which the seeds or parts of plants are classed as harmful ingredients, the presence of which is prohibited in any stock foods. These include—

> Khaki weed, Mexican poppy, skeleton weed, dodder, thornapple, morning glory, poppy, castor oil plant, noogoora burr, Bathurst burr.

Seeds of these plants are also prohibited impurities in seeds for sowing.

There is an impression among many produce merchants in Queensland that when seed, such as sorghum, has been found to contain any of these prohibited seeds, it may be sold as stock food or ground into meal for incorporation in a prepared mash without need for removing the offending material. It is most necessary that offending material be removed before further treatment is effected for stock food purposes. As an illustration, merely crushing a seed of thornapple does not destroy the poisonous principle (the alkaloid atropine) contained in the seed.

In addition, seeds such as these are often treated with insecticides and fungicides and care has to be exercised not to dispose of such seed for stock food purposes because many of the modern dusts used are harmful or have undesirable qualities for animals or birds.

APPENDIX A

Instructions for Registration of a Stock Food

"The Agricultural Standards Act of 1952"

1. The Agricultural Standards Act is designed to control *inter alia* the sale of agricultural requirements. Sale includes placing or causing to be placed on the market in Queensland, and barter and exchange and supply, and also offering or attempting to sell, and supplying or receiving for sale, or having in possession for sale, or exposing for sale, or sending, forwarding, or delivering for sale or on sale, or causing or suffering, or allowing to be sold or offered for sale. The term includes the supplying or using of any agricultural requirement under a contract of wor labour and materials.

Before being offered for sale, registration of prepared stock food is necessary. A prepare stock food is defined in the Agricultural Standard Act as follows:—

> "Any kind of meal or food for any stoc prepared, whether in whole or in part, fro one or more than one kind of grain or oils nuts or juices or meats or other materials a like nature, and any condimental, patente or proprietary food for stock possessing claimed to possess nutritive properties nutritive as well as medicinal properties, ar any material of animal or vegetable orig produced in any process of treatment manufacture not being the primary object such process, and any salt or any miner feed or supplement for stock and ar material used or intended as a lick for stoc or stock lick."

Application for Registration

2. Application for registration must be mac before sale and renewed every third year befo 31st January in the years 1962, 1965, 1968, &c so far as prepared stock foods are concerned.

3. Applications should be forwarded by th primary dealer resident within the State of Queen land to the Standards Officer, Department Agriculture and Stock, Brisbane. The applicati consists of:—

(*a*) A statutory declaration on Form A f each prepared stock food. Where the formula composition is unknown to the primary dealer, shall complete Form A by inserting the followin in para. IV. of that form:—

> "The names of the ingredients and th percentage or proportion in which each suc ingredient is contained in that agricultur requirement or the amount of each suc ingredient are undisclosed to me and th ingredients of the agricultural requireme and the respective percentages or proportion or amounts thereof will be as contained in th agricultural requirement of the same nam received by me for placing or causing to b placed on the market in Queensland or fo sale."

In this case Form A must be supported b Form B which must show the formula and t ubmitted by the person who manufactures, mixes r prepared the agricultural requirement for sale, r by his agent.

(*b*) Specimens of all labels for the various zed containers and directions or recommendations for use, if any, of each preparation (for etailed information, see paragraphs relating to bels).

(*c*) The prescribed registration fee of £1 r each preparation, payable each calendar year. hen money is tendered for payment of regis- ation fees, it should be accompanied by a list f the preparations covered by the payment. here preparations are withdrawn from sale, notification to this effect is necessary. ontinuance of registration during any three-year eriod is contingent upon the payment of the nnual registration fee during January of each ear. A penalty of 10s. for five agricultural equirements for every month or part thereof is rescribed for failure to pay on or before 31st nuary. Further, the registration is automatic- ly cancelled until both the fee and penalty are id.

The application is not complete and will not e considered until all the necessary particulars t out above have been duly lodged.

4. (*a*) If, during a period of registration, any teration is desired to be made to the composi- on or claims already registered, it is necessary submit a further application for registration.

(*b*) Where it is desired to alter any registered bel, a notice in writing (form not required) companied by a specimen of the label to be tered and a draft of the label as altered (see ra. 6) should be forwarded to the Standards fficer.

5. The printed label that is affixed to all regis- red agricultural requirements must agree in all spects with the label forwarded to the Standards fficer and registered by him.

abels

6. Before any labels, directions or recom- endations for use are printed it is most advisable submit typewritten drafts or proofs in UPLICATE. One copy will be returned with any necessary corrections. They should always be accompanied by Form A and, where necessary, Form B.

The details required on labels should be legibly and indelibly printed by a printing press or legibly and indelibly lithographed or stencilled on the packages.

Particulars Required on Labels

7. In the case of a prepared stock food the label must set forth—

Name of the stock food;

Net weight or measure contained in the package to which it is affixed;

All directions or recommendations for use including claims as to efficacy, if any;

A statement setting out—

(*a*) In the case of meals and mixtures—derived from vegetable sources—

……… % Min. Crude Protein.
……… % Min. Crude Fat.
……… % Max. Crude Fibre.

(*b*) In the case of other prepared stock foods containing the above and such other material as bone meal, lime, minerals, salt, molasses, iodine and so forth the details in (*a*) hereof must be shown together with the following, where applicable—

……… % Max. Salt.
……… % Min. Phosphoric Acid (P_2O_5) from ……….
……… % Min. Lime (CaO) from ……….
……… % Min. Magnesia (MgO) from ……….
……… % Min. Iron (Fe) as ……….
……… % Min. Sulphur (S) as ……….
……… % Max. Molasses.
*……… % Max. Meal made from ……….

Trace ingredients can be shown thus:—

To each ton (2,240 lb.)—
……… ounces potassium iodide
……… ounces copper sulphate
have been added.

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* If the percentage of added meals exceeds 50 per cent., the percentage of protein, fat and fibre derived therefrom must be declared on the label.

(*Continued on page* 586)

Root-Knot Of Ginger

By R. C. COLBRAN, Research Entomologist.

In Queensland, ginger is grown in the Eumundi-Eudlo-Buderim area, and root-knot nematodes are among the few pests with which the grower has to contend. In field trials, an 80 per cent. increase in yield has resulted from soil fumigation with DD prior to planting.

Ginger plants heavily infested with root-knot nematodes* are stunted, and the leaves may show a general yellowing and death of the margins. The aboveground symptoms are similar to those caused by a shortage of nutrients but infested plants show only a temporary response, if any, to even large quantities of fertilizers. The main roots are swollen, and well-developed nematode egg masses can be seen along the distorted secondary roots.

At harvest, nematode infestation within the rhizomes is not visible to the naked eye and does not affect the appearance of the processed ginger. When rhizomes are stored for spring planting, however, light brown areas develop around infested sites. These areas are located towards the outside and are easily seen when the rhizome is peeled.

Control

Ginger yields can be increased by (*a*) using nematode-free planting material, and (*b*) soil fumigation.

Planting material should be taken from areas of well-grown ginger plants which are not infested with root-knot nematodes.

It is preferable to grow ginger in areas where root-knot has not been a problem in previous susceptible crops. If nematodes are present, lan
preparation should be commenced at least
months before planting. When plant residu
have broken down, treat the soil with DD so
fumigant at the rate of 20 gal. to the acre. Th
fumigant is injected at a depth of 6 to 8 i
behind tines set 1 ft. apart. The soil at the tim

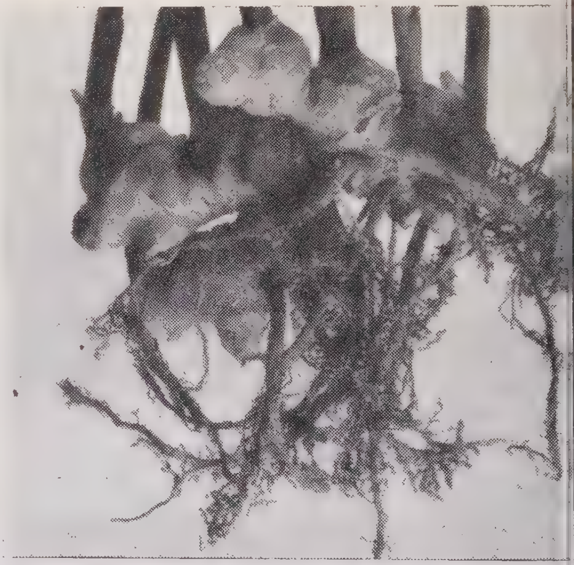

Plate 1

The Lower Part of a Ginger Plant Heavily Infested with Root-Knot Nematodes.

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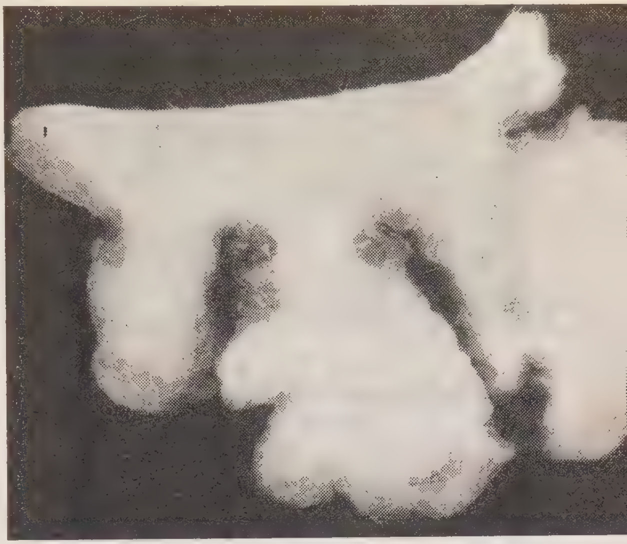
* *Meloidogyne incognita* (Kofoid and White) and *M. javanica* (Treub).

treatment should be relatively smooth and free surface clods. For more favourable results land should be treated as soon as it can be rked after irrigation or rain. Rolling mediately after fumigation will increase the el of nematode control.

Disc the treated area at monthly intervals il planting time to prevent nematode repro- ction on weed hosts. Do not plant ginger less n 2 weeks after fumigating the soil.

In field trials, DD has given better results than B and "Nemagon" before planting ginger.

Plate 2: **A Section Through a Ginger Rhizome Infested with Root-Knot Nematodes.** This type of "seed" should not be used as planting material.



rning

DD is an inflammable liquid poisonous to mans and animals but is not dangerous when perly handled. Avoid any unnecessary athing of the fumes, and contact with the skin. ter use, flush applicators thoroughly with a xture of kerosene and lubricating oil.

R.N.A.-Shell Tour

The Envy of Every Country Boy and Girl is this Line Up of Ponies at the Barolin Pony Stud, Fairymead, Bundaberg. The stud was founded in 1946 by Mr. C. A. N. Young, of Fairymead, to breed an Australian-type pony for children. Leading the ponies for inspection by members of the 1961 R.N.A.-Shell Journalists' tour are (from left): Mrs. Young, her daughter Philippa, Mr. Young, daughter Jennifer (Mrs. Cribb), daughter Penelope and Miss Shelagh Young who comes from Northern Ireland.

Plate 1

A Newly-Constructed Waterway. Note the wide spreading banks, a desirable feature. The floor of this waterway has been left uncultivated for the "bare soil" method of establishment.

Waterway Establishment On Red Basaltic Soil

By J. ROSSER, Senior Soil Conservationist.

The rapid expansion of contour farming in the South Burnett district of south-east Queensland and on the Atherton Tableland in the north has resulted in the establishment of over 300 miles of grassed waterways in the last 10 years.

To build a waterway to a desired shape and size is easy; a simple matter of earth moving. To prevent it turning into a gully is not quite so simple. A lining of grass or a grass-legume mixture is usually necessary to protect the waterway surface and prevent it from gullying.

This article deals not so much with waterway construction but with methods of planting and establishing grass in waterways.

On the red basaltic soils in the two districts mentioned there is a choice between what we will call the "orthodox" method and another method which we will call the "bare soil" method.

ORTHODOX METHOD

The orthodox method is the one recommended for general use. It involves excluding all "outside" water from the waterway and thereafter ploughing up and preparing a seedbed in the waterway much as you would for any other cr
In this case, of course, your crop is grass.

After the waterway is built, a diversion ba
should be run across the top end to exclude ru
off water. The banks that form the sides of
waterway will usually be sufficient to prev
water entering from the sides. If not, a tempor
drain or bank is run along each side. Exclusi
of outside water will minimise the risk of erosi
in the waterway while the ground is being p
pared and while the grass is young.

Now plough up the waterway and work it w
harrows or other tine implements to prepare
seedbed in the usual way. Before planting, gi
the waterway a general application of a mix
(NPK) fertilizer, at 2 to 3 cwt. to the ac
This will offset to some extent the loss of to
soil, most of which will have been used duri
construction to form the banks.

Some will prefer to construct the waterway
such a manner that at least some of the tops
is retained and spread in the waterway aft
completion. This will naturally make for mu
stronger grass growth but will make constructi
more costly.

Plate 2

A Well-Managed Rhodes Grass Waterway on H. McDonald's Property, Kingaroy. Whether the waterway is established by the "orthodox" or the "bare soil" method this is the desired end product. This was a "bare soil" waterway but is now 2½ years old. The grass has been mowed to allow water to flow freely.

Plate 3

A "Bare Soil" Waterway at Tolga on the Atherton Tableland. The photograph was taken on 16-1-56, 4 months after construction. Waterway slope is 2.5 per cent. and catchment area 150 ac.

aving worked up a seedbed in the waterway, s can be planted as soon as weather and onal conditions are suitable. When the grass grown sufficiently to protect the waterway erosion it is ready for use. Then the protective bank at the top can be removed and contour banks can be built, discharging into the waterway.

Waiting Period

A waiting period is involved between building the waterway and building the contour banks. If the season is good the waterway may be ready in 6 months. If it is a poor season for grass establishment it may be 12 months. If you miss altogether in obtaining a strike of grass it may be 2 years before you can build the contour banks. In the meantime your cultivation is eroding further. The frustration you will feel when this happens can be avoided by planning and building waterways well ahead of the time you propose to install contour banks.

Another disadvantage of the orthodox method is the difficulty and expense of providing an alternative disposal area for the water which naturally flow down the waterway site. Sometimes this problem can be easily and inexpensively resolved but in other cases it may be either impracticable or very costly.

BARE SOIL METHOD

Fortunately, on the red basaltic soils a "bare soil" method of establishment can be used to avoid the difficulty. With this method no attempt is made to exclude water from the waterway. The waterway is used while it is still quite bare. The grass comes later.

With many soils this would be inviting trouble. On the black soils of the Darling Downs, for example, a waterway unless protected with a good grass cover may rapidly erode to form a deep gully. On these soils the risk is so great that it is worthwhile going to considerable expense if necessary to exclude water from the waterway until grass has been established.

On the red volcanic clay loams, however, the odds are different. The risk of severe erosion in an unvegetated waterway is small. The chances of it grassing up before serious damage is done are good.

The risk is often taken in order to avoid costly alternative structures, or to gain the advantage of having the waterway available for immediate use.

Plate 4

A Partly Grassed Waterway. This is the same waterway as in Plate 3. The photograph was taken 2 years later on 10-4-58. The waterway shows little sign of erosion though it carried several heavy flows while completely bare.

Widely Used in South Burnett

In fact, the method has been widely used on red volcanic clay loams in the South Burnett and Atherton districts since 1955, when the first "bare soil" waterway was tried and found successful.

When the South Burnett or Atherton farmer wants to install contour banks on a paddock he often has the contour banks marked out at the same time as the waterway, and builds them at the same time too. It may rain the next day but there are no harmful effects. His contour banks work to perfection. And the waterway? Well, it has to work too. Any loose soil left in the waterway during construction will wash away but this is reduced to a minimum by follow the recommended construction method. T waterway may be subjected to a number of flo over a period of 3 to 4 years before grass becom well established in it, but erosion in the waterw is rarely severe.

Plate 5

A Typical "Bare Soil" Waterway at Kingaroy. Some rilling has occurred but grass is gradually growing in from the banks. The waterway is 3½ years old. Waterway slope is 6 per cent. and catchment area 75 ac.

The explanation lies partly in the soil ty Even though they erode readily when cultivat the red volcanic soils have a subsoil relativ resistant to erosion. The firm red subsoil w take high velocities without scouring deeply.

Construction Method

The construction method is important t The waterway must be carved out of the s leaving a firm bottom. All soil loosened construction must be pushed into the ban Ripper or tine marks must not be left. If co struction is done with a light farm dozer or grader it is preferable to loosen the soil with disc or mouldboard plough rather than with tined implement such as the chisel plough. U of the disc or mouldboard plough makes it ea to leave a firm hard bottom.

A third requirement is that soil type, clim and available grass species must all be such th eventual grass cover will be obtained. The b soil waterway will not resist erosion indefinite

Grass Planted on Banks

In order that a grass cover may be obtai within a reasonable time, grass is planted on banks of the waterway. A single row of pla at the original ground level will do, provided species selected colonises laterally by sending runners. At this level the grass plants won't washed away; and the fertile topsoil will grow vigorous plant capable of sending out runners cover the floor of the waterway. Fertilizing w a mixed fertilizer followed later by a top-dress of nitrogen-rich fertilizer such as sulphate ammonia will help. If the species used can grown from seed, the whole of the waterway ba is planted. The floor of the waterway is worked up into a seedbed and is not planted.

The grass species used must be capable colonising the bare floor of the waterway. Th means that a grass that sends out runners m be used. Species that have been used successfu in Queensland are Rhodes grass (*Chl gayana*), kikuyu (*Pennisetum clandestinun* common couch (*Cynodon dactylon*) and Afri r grass (also a *Cynodon dactylon*). These h have advantages and limitations which will dealt with later in this article.

vey of Kingaroy Waterways

A recent survey of 31 2½ to 4½ year old "bare " waterways on red soils in the Kingaroy area wed that the method is practical but not ideal. ctical, because in spite of the fact that half the waterways had not been planted even on banks, 26 out of the 31 were either well- ssed already or showed indications that ntual complete stability was only a matter of e. Not ideal, because some trouble was being erienced with five of the waterways.

Seventeen of the 31 were well grassed and wed little erosion. Four others showed only or erosion but were not well grassed. Five re had eroded to a depth of over 1 ft. but were l grassed with grass established in the washes were expected to stabilise without any special tment.

The remaining five waterways were less satis- ory, being poorly grassed and eroded to a th of over 1 ft. Excuses could be found even these. Three had not been planted and much the bank area had no suitable grass. One overgrazed and one had a soil profile show- a lot of gravel and should not have been ted by the bare soil method.

None of the waterways in the survey had ched the stage where the gully in the waterway cutting back along the contour banks.

advantages

There appear to be two main disadvantages to blishing waterways by the "bare soil" method. first is the possibility of erosion in the water- which may result in a rough uneven bottom ch is difficult to mow and maintain.

The second is that the waterway tends to be rded as a waste area. The grass that grows the bare soil is unthrifty at first and may ain relatively unproductive for a long time. the other hand, a well-prepared waterway, sed before it is used, can become a high- ducing strip of pasture for grazing or hay luction.

ich Method to Use?

n spite of these disadvantages, the "bare soil" hod is recommended for limited use in certain situations. It can only be used, of course, if the soil type is suitable.

It is very useful when a waterway is required in the lower parts of a catchment where exclusion of run-off water from the new waterway may be both difficult and expensive.

Where exclusion of run-off water from the waterway can be effected easily there is less justification for the use of the "bare soil" method. It can be used when contouring of a particular paddock is needed urgently. But, where contour banking needs can be anticipated in advance, it is preferable to build the waterways in advance, and to grass them by orthodox methods.

Plate 6

A Seriously Gullied Waterway, Kingaroy. Banks of this bare soil waterway were not planted so that the whole waterway remains bare with no prospect of grass to halt erosion. Waterway slope is 3 per cent. and catchment area 35 ac.

Plate 7

Grass Establishment by Runner in an "Orthodox" Waterway. African star grass in the foreground has covered the whole area from 8 ft. x 8 ft. spacing, while kikuyu in the next plot planted at the same time still appears as clumps only 4 ft. in diameter.

SEEDS OR RUNNERS?

Whether you use the "orthodox" or the "bare soil" method, the waterway must be planted with grass. Seed or vegetative material (turfs or runners) can be used. The choice of planting material will depend to some extent on the species used. Some can only be planted by turfs or runners. Other, for example, Rhodes grass, can be planted either way.

Seeding involves less labour and is usually preferred on this account. A disadvantage with seeding, however, is the difficulty of establishing a good stand. It is not only a matter of obtaining a good germination. Both frost and hot dry weather can kill off the young seedlings. Seed can be sown any time from spring to late summer but the wet season rains offer the best prospects of favourable follow-up weather. These rains occur sometimes as early as December on the Atherton Tableland and usually somewhat later in the South Burnett.

Planting of turfs, that is rooted clumps of the grass, is time-consuming but sure.

Planting of active growing runners is a method which should be given consideration. It is often possible to get a good strike by this method even in a season where seeding would have failed. This can mean 12 months saved in a contour banking programme. With most of the species suitable for waterway stabilisation a runner half buried in moist soil and tramped in, leaving the tip exposed, will usually grow even if follow-up rain is not received for 2 or even 3 weeks. Spacing recommended for most grasses is 3 to 5 ft. With African star grass, planting at 8 to 10 ft. centres is enough. Such a wide spacing makes hand planting of a waterway quite a practical proposition. Planting can be done any time during the spring or summer, provided the soil moisture is suitable.

The job of planting turfs or runners can be lightened by using mechanical planters. (See Advisory Leaflet No. 522 for further information on this aspect.)

GRASS SPECIES TO USE

The species most commonly used on the red soils are Rhodes grass, kikuyu, African star grass and common couch.

Rhodes grass.—This is a safe, sure species and is the most widely used to date. It is easily established by seed or runner and seed is readily available. The grass spreads well on red soi and forms adequate protection for the waterwa Encroachment from the waterway onto cultivatic does not present any problems as the grass readily killed by cultivation. It is palatable stock and widely used as a pasture plant.

The one big disadavantage of Rhodes grass f waterway stabilisation is that it grows too bull and tends to choke the waterway with gras thus reducing its water carrying capacity. Mov ing, grazing and burning are practices adopt for the removal of bulky topgrowth, and if w maintained in this way the grass is quite suitabl (For further information see Advisory Leaf No. 305).

Kikuyu.—Treat this one with caution on r soils, particularly on the fertile red scrub soi Planted in eroding gullies, kikuyu can do wonderful job of reclamation but in small wate ways on fertile scrub soils it is too vigorous a tends to choke the waterway and contour ba outlets. It is not easy to control encroachme at the ends of the contour banks where the gra is difficult to get at with a plough.

It can be killed by cultivation in the op paddock and is recommended for use in reclai ing gullies and gullied waterways, particularly t large waterways in lower parts of catchm areas. (For further information see Advis Leaflet No. 327.)

African star grass.—An excellent waterw grass as yet not widely used on the red soils is growing in popularity. There are seve strains of this grass and they vary in gro habit and size, so consult your soil conservati adviser in order to obtain the most suita waterway strain.

African star grass is outstanding in its abi to spread and colonise a waterway. Growth r of the runners is much faster than any of t other species mentioned in this article. Its abi to spread quickly means that a wide plant spac (up to 10 ft. x 10 ft.) is usually sufficient ensure a good cover within 12 months. T grass has excellent soil-holding properties a from the aspect of waterway stabilisation is ve desirable as it offers little resistance to the passa of the water.

It is very palatable to stock and has hi nutritive value. It invariably shows traces prussic acid on analysis and must be regarded a possible danger to stock through poisoni wever, feeding trials carried out at Rockhamp- and Biloela by the Department over a number years have not resulted in any cases of prussic d poisoning in stock.

t is necessary to control encroachment onto cultivation land by this fast-growing grass. does keep trying to grow out into the cultiva- n but it can be controlled relatively easily by nventional implements. It is more easily con- lled than either kikuyu or common couch but n be expected to give more trouble than Rhodes ss.

Common Couch.—This is a common weed of tivations in both the South Burnett and the nerton Tableland. It has established itself in number of waterways. As a waterway grass it excellent properties because it is a good soil- der and is very short.

A disadvantage is that it does not provide as much feed for stock as the other grasses discussed. Being a weed of cultivation, its use is not recommended except where infestation of the cultivation already exists.

For Further Information

——————— Rhodes Grass. Qld. Dept. of Ag. & Stock Advisory Leaflet No. 305. Extract from the Qld. Ag. Jour. Feb., 1954.

——————— Kikuyu Grass. Qld. Dept. of Ag. & Stock Advisory Leaflet No. 327. Extract from Qld. Ag. Jour. Aug., 1954.

R. F. S. KELSEY. Chisel Plough Plants Grass Roots. Qld. Dept. of Ag. & Stock Advisory Leaflet No. 522. Extract from Qld. Ag. Jour. May, 1959.

R.N.A.-Shell Tour

Every Hair's in Place when Frances Jamieson, 14, of Redcliffe (left), and Margaret Fuller, 14, of Palmwoods, Have Finished Grooming this Jersey Heifer for a Field Day. And the heifer, Nambour Rural School Golden Lass enjoys it all! The girls, both sub-junior students at the Nambour State High School, take an active part in the school's agriculture project. Members of the 1961 R.N.A.-Shell Journalists' tour saw them at work when they visited the school.

Plate 1

Steers Fattening on Non-Irrigated Lucerne in the Spring. This crop was growing on creek flats north-west of Taroom. Lucerne can provide valuable feed throughout the year and grows on a variety of soils in the district.

More Beef From More Feed And Water

By K. F. HOWARD, Formerly Senior Adviser in Cattle Husbandry.

Property improvement in the Miles district is discussed in this article. The costs of wate supplies, fencing and provision of more grass are considered in relation to beef production.

Good grazing land without a water supply is worthless as a pasture for stock. In fact, most drought losses in the better class grazing land have occurred because of an inadequate permanent water supply.

Provision of cool, clear water should be the cattleman's primary consideration.

Some properties in the Miles area have permanent holes on creeks or rivers. The value of some of these holes is often reduced because of their tendency to become boggy. This causes muddy water and losses of stock in times of drought. In good country, fencing-off of permanent holes is usually an economic proposition. When permanent holes are on the boundary, the fencing off of water would often pay simply through time saved in avoiding trouble with neighbours' cattle.

Most of the bores in the area are subartesian, varying in depth from 400 to 1,500 ft., with some outside this range. There are quite a few parts of the area where boring is a doubtful propos tion. In many cases the water is too salty, b in others it is very suitable.

A 600 ft. bore would cost a little under £2,0 when fully equipped. It is assumed that th will supply water for two paddocks.

The approximate costs of one 600 ft. bo with water pumped from 200 ft. are:

	£	s.
Boring at £1 per ft.	600	0
5 in. casing at 14s. per ft.	420	0
16 ft. windmill	420	0
3 in. pump casing 6s. 9d. ft. (200 ft.)	67	10
Pump rods 200 ft. at 4s. 6d. ft. ..	45	0
Pump and piping to trough 60 ft. ..	35	0
Troughs; 4 lengths of cement troughing at 30s. ft. (2 watering places, 2 lengths each)	36	0
10,000 gal. tank and erection ..	200	0
Erection of mill (£6 per ft. of wheel)	96	0
Setting up of troughs, trough guards and fitting pipes	30	0
	£1,949	10

Two of the most important points to be considered in tank sinking are economy of effort, and producing depth of water. Tank sinking costs 2s. 6d. a cu. yd. of earth moved. So it is desirable to store as much water as possible for each yd. of earth moved. Excavation from within the proposed dam area should yield a return of up to 3 to 4 yd. of water stored for every yd. moved. It is surprising that there are so many tanks where this point has been overlooked. Depth is also very important because evaporation can be high (up to 5 to 6 ft. a year). If permanent water is the aim, tanks should be 15 ft. or preferably deeper.

Pre-war, it was usual to have tanks of 4,000 cubic yards capacity or even less. Now it is common to build tanks of 6,000 cubic yard capacity or even larger, with extremes up to 30,000 cubic yards.

Back waters can often be put to further advantage by pumping out of them into the tank in order to have as deep a supply as possible at the beginning of a dry period. The smaller the surface area, the less is lost by evaporation.

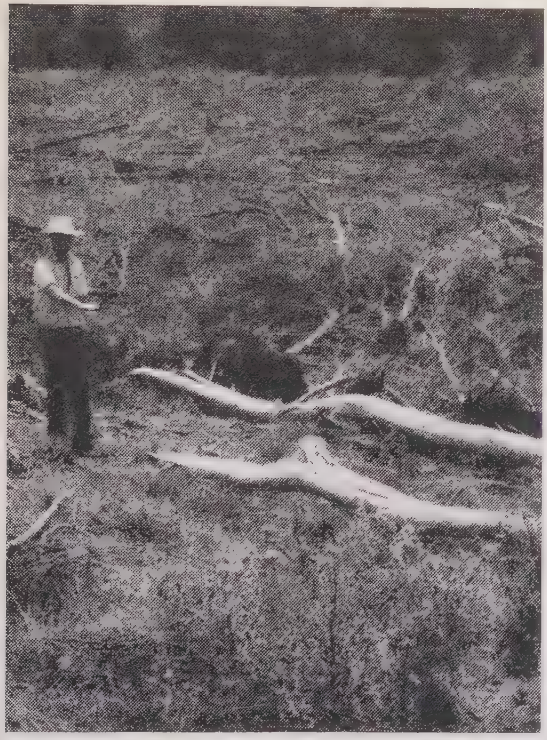


Plate 2

This Brigalow Softwood Scrub in the Wandoan Area Was Pulled by Means of a Chain Dragged between Two Heavy Tractors.

There is also a place for the 2,000 to 4,000 yd. tank. This is particularly so when water is required mainly for cultivation paddocks. Under these circumstances the cattle are turned off before the summer.

An outlay of £300 to £400 is well spent in fencing off and equipping a tank. Cattle drinking directly from the tank foul the water and cause silting up. A tank that is badly silted up could cause far greater financial loss in a drought than the cost of equipping it with a mill and trough.

The costs of an earth tank are:

COSTS OF SINKING TANK TO STORE 9,000 CU. YD. OF WATER

	£
Excavation of 6,000 yd. at 2s. 6d. a yd.	750
Turkey's nest, 40,000 gal.	100
10 ft. mill and pump, 3 in.	150
Erection of mill, fencing 4 lengths of troughing (2 lots of 2) pipes and fittings	150
Total	£1,150

Short troughs of two lengths or so are a means of keeping water cool if the delivery pipes are well buried.

Fencing

The cost of fencing is around 8s. a post plus cost of wire. Most fences have panels from 13 to 15 ft. A mile of fence with 13 ft. 6 in. spacing costs £157 plus wire. Panels of 15 ft. cost £140 a mile. The most common fence has 2 barbed wires of 12½ gauge and 2 plain wires of 10 gauge. The cost of barbed wire per mile is £17 compared with £9 for plain. This makes a total cost of wire £52 a mile. A 3-barbed fence would cost £51 for wire. Total cost per mile of fence is therefore around £200.

Properties that are well subdivided permit adequate pasture management. Paddocks of native or improved pastures provide superior feed if allowed to spell and re-seed. Fencing is essential for proper management of pastures. Strategic fencing allows a maximum use of feed and is convenient for mustering.

The clearing of timber along fencelines is becoming a common practice. A track for a vehicle can save much time and labour in checking and repairing.

New paddocks usually mean new watering points so that this expense must always be considered. Often it will not pay to put down a £2,000 watering point. In such cases, a pipeline from a good supply could be much cheaper. Small tanks have a definite place even though they may not provide permanent water. When they contain water the paddocks can be grazed. When the tanks become empty, cattle can then be moved onto permanent waters where the paddocks have been spelling.

Timber Treatment

It is a common observation that a tree in a cultivation paddock permits very little growth of crop in its vicinity. The early settlers were quick to capitalise on the growth of feed that resulted when the timber was killed. Unfortunately, the energy of the settlers has not continued on some holdings so that often a property where green scrub predominates will be carrying almost all of the cattle on a relatively small ringbarked area. This situation is rapidly changing. Ringbarking is still popular but other methods have been developed.

Plate 3

Brigalow Sucker Country Converted to Productive Cultivation within 12 Months. This timber was pulled by a chain drawn between two tractors. Then it was pulled a second time but in the opposite direction. The area was then burnt, stick raked and ploughed with a heavy disc plough. Total cost should be recouped in one season of oat grazing.

Plate 4

Rhodes Grass in Brigalow Country in the Wandoan Area in March, 1956.

Brigalow scrub[1], poplar box[2] and silver-leaf ironbark[3] are the main timbers that are treated, together with the species that grow in association with these trees.

Types of Country and Treatments

(*a*) *Brigalow Scrub:*

Ringbarking is best employed on virgin scrub where there is little undergrowth. Bushy species increase costs by slowing down operations. The main disadvantages are the time taken to treat a big area and the scarcity of good ringbarkers. A competent ringbarker will ring from 1 to 3 acres a day according to the scrub. Cost per acre varies from 25s. to £2 in brigalow scrub. Heavy vine scrub may cost up to £5.

There is general agreement that brigalow scrub should not be burned until at least 3 years after ringbarking has been completed. Quite often, 5 years are allowed. It is claimed that early fires are often the cause of sucker growth.

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[1] *Acacia harpophyila*

[2] *Eucalyptus populnea*

[3] *Eucalyptus melanophloia*

Where wilga[4] is heavy and not ringbarked it can create a problem. Normally a good fire will kill wilga but sometimes its growth is so rapid that it prevents the growth of grass which is generally necessary for a satisfactory fire in this type of scrub.

Aerial Spraying.—An extensive amount of hormone spraying was carried out through the area from 1953 to 1955. The percentages of brigalow kill varied from 10 per cent. to nearly 100 per cent. This method has lost favour compared with ringbarking and pulling, however, as there are a number of trees and shrubs that grow in association with the brigalow that are not affected by the hormone spray. Cost per acre in the early stages was in the vicinity of £2 10s. Prices in 1958 were around 35s. an acre.

Pulling with Tractors.—This method has mainly come into prominence in the area since 1954. Green scrub and ringbarked country are both being pulled, with green scrub comprising by far the greater proportion. High-powered crawler tractors move forward, dragging between them a steel cable, a ship's anchor chain or both. Steel balls have been used but it is not a popular method.

In the last 5 years it is considered that between one half and one million acres of brigalow scrub in the area have been cleared by pulling.

The method is spectacular and quick. Following the pulling of green scrub, the timber is burned. Some blocks have been fired immediately the pulling has ceased. In other cases, the pulled area has been left for 2 years. The latter method often permits more thorough burning of the stumps and roots. This is an advantage if the land is to be cultivated. Mostly, the areas are fired on a hot breezy day in November or December.

These areas are commonly sown with Rhodes grass[5] from horseback or by plane in January or February. In summers of good rain, the Rhodes grass has permitted heavy carrying of stock during May when the grass is usually seeding. The majority of areas treated in this way have been satisfactory enough for the method to increase in popularity. The transformation from practically useless scrub to first class grazing country has taken place on many occasions within 6 months. Some properties have been successful in treating several thousand acres in this way. When summer rains have failed, resowing of Rhodes grass has sometimes been carried out in the following year.

Costs per acre have shown a big variation. Costs vary according to the type of scrub, the topography, the method used, the type of plant and skill and reliability of the operators. Scrub in which brigalow trees predominate is usually the cheapest to pull. Big belah,[6] poplar box and heavy vine are inclined to slow down operations. Steep gullies will cause a lower average tractor speed.

The cable method is usually the cheapest. It is inclined to ride 6 to 20 ft. above ground level in green scrub and so obtain extra purchase on trees. The chain generally remains within a few feet of ground level. The pull with the chain is heavier, which means that a narrower strip is necessary.

Some contractors have used both chain and cable together. This is cheaper than the chain only, as the cable does the pulling and the chain follows on behind and drags out many of the roots.

Delays whilst the tractors are in operation are costly and it has been found cheapest to use high-powered crawler tractors that can keep moving except for particularly large trees. These tractors are generally of 140 or more horse power. The cost for the 2 big tractors varies from £25 to £28 per hour.

The cost per acre of pulling green scrub with the cable averages about 30s. Some areas of green scrub have been pulled for under £1 per acre whilst some blocks of heavy scrub have cost up to £3 10s.

Where the scrub has been killed with ringbarking or spraying, cost per acre of pulling is generally £1 or under. Brigalow suckers have often proved a problem. A common method of overcoming this at present is to pull the suckers with a chain. In 2 or 3 days' time the tractors go back over the suckers pulling them in a direction opposite to the first pull. The suckers are then burned and the country is either stick-raked or stick-picked. After most of the sticks have been picked, the area is disc ploughed and planted to crop.

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[4] *Geijera parviflora*

[5] *Chloris gayana*

[6] *Casuarina lepidophloia*

The costs of clearing brigalow for cultivation could be: Ringbarking 30s., pulling 2 years later £1, burn, stick rake or stick pick 30s., making a total of £4.

If bulldozers are used initially, the costs may be: Pulling green timber 30s., burning immediately, stick raking and burning of stumps pushed up 50s. (varies from 30s. to 60s. according to burn). Cost £4.

The first ploughing is done with a sundercut or heavy disc plough. The actual cost of clearing suckers for cultivation on a Meandarra property in 1958 was as follows:

Pulling one way with chain, 35s. Pulling back again 35s. (contract price). Burn. Contract stick picking 30s. per acre. Total cost in getting ready for the plough, £5.

The initial ploughing is generally fairly costly. The rate of ploughing varies from 1 to 4 acres per hour. The first ploughing cost can vary between 15s. and £3 an acre according to the state of the country and the type of the plant used.*

There are two different approaches to bringing country into cultivation:

(*a*) Treat country by ringbarking or with the other methods and allow to stand for 2 or more years before burning. This usually facilitates easier ploughing as there is generally a better burn and the country is often not so rough for the first ploughing as it would be if it had not been allowed to stand.

(*b*) The other approach is that you expect to clear, say, £7 per acre per year from grazing crop after allowing for all costs. Every year that you have it lying uncultivated, the loss is equal to the difference between the £7 and the grazing value of the country that has had only timber killed. Such grazing value would probably be in the vicinity of 30s. per acre. In such a case, £5 10s. to £6 per acre is the undeveloped potential for each year when the paddock is not producing to capacity.

Pasture.—After burning of brigalow, the area is most commonly sown to Rhodes grass. While this can be done from horseback, the most common method of sowing big areas now is by air. Cost is about 5s. per acre for the plane with reductions for areas involving over 1,000 acres. Rhodes grass seed is generally planted at the rate of 2 lb. per acre. Cost of seed is usually around 4s. or 5s. a lb. Some areas have been sown to green panic[7] or buffel grass[8] but the cost of seed is usually over 10s. a lb. These grasses, though holding some advantages over Rhodes, do not spread with runners and are not nearly so quick at providing the volume of grazing from the same quantity of seed.

(*b*) *Box and Ironbark:*

The country where poplar box or silver-leaf ironbark grow is often used for crops and cultivation. Before ringbarking it is generally of more grazing value than brigalow country, but in most cases improved eucalypt country is inferior to improved brigalow country.

As a general rule, the cost of timber treatment is greater for eucalypt country than brigalow. Initial ringbarking varies from 15s. to 30s. with most of it around £1. Eucalypts generally need at least one suckering the following year. This is likely to cost 10s. Quite often one or two subsequent suckerings are required at an approximate cost of 5s. an acre.

The carrying capacity of ringbarked eucalypt country varies greatly. Some of it would be the equal of, or better than, average brigalow country whereas other box country might carry a beast to 10 or 12 acres when improved. This would compare with a beast to 6 or 8 acres of brigalow that has been ringbarked. Eucalypt country does not lend itself to the sowing of grasses after burning. As a rule the bulk of the area is already producing native grasses when ringbarked. Usually, ashes provide the best seed bed. The amount of ash left from burning box country is very small in relation to brigalow country. In burnt brigalow scrub, the ash provides an ideal seed bed.

The pulling of dead box or green silver-leaf ironbark costs in the vicinity of 25s. an acre.

If preparing eucalypt country for cultivation, the cost is generally greater than for brigalow country. Ringbarking and one suckering is likely to cost at least 30s. per acre. Where the timber is not heavy the cost of pulling dead eucalypts is about 15s. per acre. It is then bulldozed into

(*Continued on page* 569)

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[7] *Panicum maximum* var. *trichoglume*

[8] *Cenchrus ciliaris*

* In the Chinchilla district the contract prices for initial ploughing with a heavy plough were from £4 to £5 an hour or £1 to £5 per acre.

Coping With Worms In Cattle

By E. R. JOHNSON, Veterinary Officer, and
A. HUTCHINGS, Senior Adviser in Cattle Husbandry.

Worm infestation in cattle takes heavy toll of production, particularly dairy production. Deaths of young stock from worms are sometimes numerous but economic losses due to slow growth, delayed maturity, susceptibility to other disease and consequent reduced yields, are very high.

They can be controlled by good husbandry, and the proper management of stock and pastures. If properly controlled, they cause little harm.

The continuous supply of adequate nutritious feed, and rotational grazing backed by judicious drenching will prevent harmful levels of infestation, and control worms.

Worm infestation in young cattle is a common occurrence over practically all of coastal Queensland and, to some extent, inland. Losses by death can be measured but loss through lowered resistance to other diseases, retarded growth and decreased production as the result of worm damage is very considerable.

Conditions

Calves and young stock are "a sitting shot" for worms if they are in poor condition or on a declining plane of nutrition.

Greatest infestation is associated with wet spells, humid conditions, damp soil and high rates of stocking.

Damp soil conditions favour the survival of young worm larvae, and the natural resistance of young stock is reduced by inadequate nutrition and poor health. Such conditions prevail when young stock are confined to small areas of native pastures without adequate supplementary feed; or where they have larger areas of such pastures with a gully or two which provide the most—but insufficient—green feed. These gullies are thereby heavily stocked and continuously grazed.

Insufficient nutritious feed to supplement grazing when calves are weaned off milk will also reduce their natural resistance to worm infestation. This applies particularly to calves reared with small quantities of wholemilk on wholemilk supply dairy properties.

Damage

Except for a few species, relatively small numbers of worms do little apparent harm to the host animal but large numbers do untold damage. For example, 4,000 to 5,000 hairworms may cause little harm to a 4 or 5 year old beast, while 200 hookworms could cause its death.

As with other diseases, the damage is proportionate to the extent of infestation. Most worms are blood suckers. Part of their life is spent in the digestive tract of the animal, where they rob their host of some, maybe much, of its life blood. As

Plate 1

Set Stocking and Boggy Yards Favour a Worm Build-up. These calves were backward, continually scouring and would not seem to grow. Examination of their faeces revealed a high hookworm egg count. Under their system of rearing they were kept for many hours each day in this boggy yard hence a worm build-up was inevitable.

will be explained later in the life history of the different species, a few species cause considerable damage to the lining of the gut thereby impairing the ability of the animal to absorb the food nutrients—in fact smashing the bridges!

Some species such as lung worms do some mechanical damage in their burrowings through internal organs and eventually obstructing or totally blocking air passages in the lungs.

While the large stomach (barber's pole) worm has generally caused the greatest economic loss, a considerable number of hookworm infestations have been known in southern Queensland during the past 2 years.

Very light infestations induce the build-up of resistance to heavy infestations. However, from a practical aspect animals kept relatively free of worms do carry light infestations. Research is at present being conducted on the problems and benefits of rearing stock in entirely worm-free conditions.

Too often worm infestation is not suspected until a few, maybe many, animals are obviously losing condition.

The damage, then, from worm infestation causes any or several of the following conditions: loss of blood; smashing the bridges for food absorption by damage to the lining of the gut; clogging of air passages in the lungs; general discomfort to the host animal. Is it any wonder that recovery is slow, even when worms are effectively removed?

Diagnosis

Common symptoms of worm infestation are loss of condition, dry "harsh" coat, and pot belly. Upon close examination the gums and the membranes in the corner of the eyes are pale. These membranes are pink or have pink streaks in healthy animals. There may also be scouring and a typical bottle jaw due to dropsical swellings in the angle of the throat and along the jaw.

Characteristic symptoms of lung worm infestation are frequent light or husky coughing and heavy breathing. Some or several of the symptoms previously mentioned will also appear.

Not all of the symptoms mentioned show up at the same time or in the same animal. Nevertheless, when a few young cattle show some of he symptoms during showery periods, or about weeks following showery periods, worm infesation should be suspected and a closer examinaion of the animals made as soon as possible.

Animals are usually infested simultaneously vith several types of worms, for poor nutrition f animals and damp pastures favour survival of ll types of worms.

If confirmation of diagnosis is needed before reatment, it is suggested that one of the least aluable animals showing "wormy" symptoms be illed and a post mortem carried out. Careful tudy of the detailed life history of the different vorms given later in this article should enable the perator to examine the alimentary tract and ssess the extent of infestation. Appropriate reatment can then be carried out.

Alternatively, faecal samples from half a dozen ffected animals should be sent for analysis to he Animal Research Institute, Yeerongpilly, or ts counterpart at Oonoonba. The samples should e taken individually from the rectum and kept eparate. Samples should be about 2 to 3 oz. ach. They should be put in screwtop jars, ecurely fastened and correctly labelled. An ccompanying letter must be sent giving particuars of number and age of animals in the bunch, umber affected, the general condition of pasture eed and any supplementary feed given. History f the rainfall during the preceding month should lso be added.

nimals Affected

Young cattle from 6 weeks old up to 2 years re susceptible to heavy worm infestation. Calves nder 6 weeks normally graze very little and so lo not pick up many worm larvae; for, as will e discussed later, pasture is the main source of nfestation.

Contrary to opinions held by some laymen, attle over 2 years old very rarely suffer heavy vorm infestations and even then only when they re suffering malnutrition.

Both beef and dairy cattle calves and young tock are affected, but dairy cattle are subject to eavier worm infestations because of heavier tocking rates and underfeeding at critical times n their life.

Vorm Control

The conditions favourable for heavy worm nfestation are poor quality feed and lowered condition of stock, damp pastures and uncontrolled grazing. The basic principles of worm control—prevention of heavy infestations—embody the regular supply of good quality feed to the stock and the maintenance of relatively worm free pastures by rotational grazing.

There are two schools of thought in worm control in cattle. They are:

1. The maintenance of a high plane of nutrition to enable stock to resist pathogenic worm burdens.
2. Regular drenching to keep stock relatively free from worms.

Under Queensland conditions it is recommended that these thoughts be combined whereby drenching is carried out only on occasions when the natural resistances of animals are unavoidably reduced.

Infestation is most likely to occur in spring, during the summer and in autumn. No harmful effects on the animals are seen when feed is adequate and nutritious unless animals are exposed to overwhelming infestation. However, harmful effects do show up particularly during the winter when feed has dropped in quality—and palatability—and cattle lose condition.

Observations over the past few years have shown that young cattle lose condition from May onwards when confined to unimproved pastures. At the same time they suffer heavy worm infestations. They have been brought back to good health and growth only by appropriate drenching and adequately improving the daily feed with young grazing crops plus leafy hay and perhaps some meal.

Rotational Grazing

Observations on calf rearing trials have also shown that calves can be maintained in continuous growth and health by rotational grazing supplemented with leafy hay and some meal as soon as pastures come into flower and commence to drop in quality—and palatability.

Heavy worm infestations and their damaging effects are thereby prevented.

Paddock layout should be arranged to allow a fresh paddock preferably each week and also allow at least a month's spell before regrazing. During this spell a large proportion of the young

Plate 2

Fat, Healthy Heifers Are a Produce of Sound Husbandry. This owner practised strategic drenching—that is, in spring, mid-summer and autumn regardless of the calves' condition. Rotational grazing then ensured a worm-free pasture of high quality.

worms will have died of starvation, for they can only survive and complete their life cycle in the gut of cattle.

As far as practicable, damp areas should be drained free of surface water, for such areas often produce more feed—and allow more worms to survive.

Poor quality pastures are unsuitable for calves and young stock; indeed they are unsuitable for any dairy stock. Such pastures must, therefore, be adequately supplemented. On the other hand, high quality pastures support greater numbers of stock which in turn increase infestation of pastures with worms unless grazed rotationally at intervals of not less than a month.

Life History of Worms

Queensland cattle carry numerous types of worms but of these only a handful are capable of producing disease. However, the worms in this handful are widely distributed over our cattle population. They are well adapted to the climate and will quickly play havoc if not checked. However, they have weak chinks in their armour; they must live inside a host, and here, we can get at them. They must also have a transmission stat not associated with the host, and, once again we can get at them.

Think of the worms of cattle in four groups— small roundworms, tapeworms, lungworms an the flukes. The first group, small roundworms are our greatest problem. Lungworms caus rather widespread trouble, whilst the other tw groups, tapeworms and flukes, are not of grea concern.

Let us look into the groups in more detail:

1. Small Roundworms

In this group the worms concerned are liste below with comment; the order of listing is th order of importance—

Worm	Popular Name	Importance
Haemonchus placei . .	Barber's pole worm	Very important
Bunostomum phlebotomum	Hookworm . .	Important
Oesophagostomum radiatum	Nodule worm . .	Important
Trichostrongylus species	Hairworm . .	Can be a concer where nutritio is critical
Cooperia species . .	. .	Sometimes troublesome i calves
Ostertagia species . .	Brown hair worm or brown stomach worm	Not important
Trichuris species . .	Whipworms . .	Not important
Nematodirus . .	. .	Not important

It can be seen that the two worms of importanc here are barber's pole worm and hookworm. L us look at them more closely.

Barber's Pole Worm

Distribution.—This serious parasite is found a along coastal Queensland, Darling Downs an Central Queensland. Infections occur as far wes as Barcaldine and Charleville. It is a parasit of summer rainfall areas.

Life History.—Eggs are passed out in parasitised animal's faeces and contaminate th pasture. One female worm can lay up to 10,00 eggs per day for several months, so, given th right conditions, a mammoth build-up can occu in a herd. Moist humid weather is ideal for eg hatching and voided eggs hatch quickly and pro

Plate 3
Barber's Pole Worm; Natural Size.

duce an *infective larva* in about 6 to 7 days. Should a low temperature prevail at the time, this process may take many weeks. Desication at this particular time would destroy the larva. The infective larva is eaten, and attaches to the wall of the fourth stomach (abomasum), where it reaches maturity as early as 15 days after ingestion. By 30 days the female worms are at the peak of egg production and so the cycle is complete. A burden of 1,000 worms frequently produce disease even though, on autopsy, 1,000 of these 1 in. long worms do not occupy much space.

Symptoms.—Though barber's pole worm is *acquire*d in summer its *effects* are not always seen until winter when nutrition has deteriorated. It is important to remember this. Most symptoms and deaths are encountered in mid-winter to spring.

Barber's pole worm is a blood-sucker and symptoms are largely anaemia, ill-thrift and sometimes severe scour. Secondary signs like "bottle-jaw" and reluctance to feed soon follow. Mid-winter deaths are common.

Treatment.—The best anthelminthic (worm drench) for use against barber's pole worm is phenothiazine. This drug is readily available under several trade names.

Two drenches should be given at an interval of about 3 weeks. This second drench is given because of the fact that phenothiazine is not so efficient against immature worms. So, 3 weeks later, when the young worm has just matured, the second phenothiazine drench follows.

The newer phosphatic drenches are also effective against barber's pole worm but great care must be exercised in their use as accidental overdosing can have severe consequences. If phosphatic drenches are used against this worm make sure you are dosing at the lower rate recommended and for the particular age of the calf concerned.

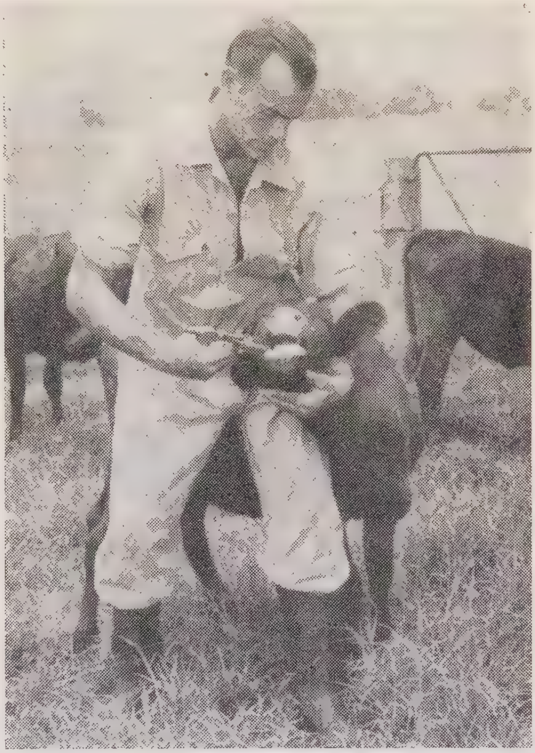


Plate 4
A Calf Receives its First Mid-Summer Drench with Phenothiazine. This will be followed in 2 to 3 weeks by a repeat drench. Two such drenches given in spring, summer and autumn constitute strategic drenching.

Recommended dose rates of phenothiazine are:

	Phenothiazine powder
2 to 4 months	½ oz.
4 to 6 months	¾ oz.
6 to 12 months	1 oz.
12 to 18 months	1½ oz.
18 months and over . .	2 oz.

The powder may be mixed in any quantity of water to suit your drenching technique or your drenching gun's capacity. However, the following quantities give a suitable suspension in easily remembered figures; if 16 fl. oz. of water are added to 1 lb. of phenothiazine powder then the dose rates are:

2 to 4 months . .	. . 1 fl. oz.
4 to 6 months . .	. . 1½ fl. oz.
6 to 12 months . .	. . 2 fl. oz.
12 to 18 months . .	. . 3 fl. oz.
18 months and over	. . 4 fl. oz.

Remember, phenothiazine does not dissolve in water; it forms a suspension. Hence a mixed suspension must be stirred constantly while in use to avoid under or over dosing. Commercial phenothiazine suspensions are available. These should be stirred constantly and used according to directions.

Control.—Control of barber's pole worm is, unfortunately, a foreign thought to many of us. This is borne out each winter by the number of barber's pole outbreaks that suddenly occur, and on these properties belated control is undertaken. In these cases treatment and control must be applied together. This is unfortunate, since, apart from the calves that die, the treated animals that survive are in for a lean time because:

(*a*) Pastures are carrying infective worm larvae and re-infestation is bound to occur.

(*b*) Even in treated calves the initial depression exercised by the worms on the animals' blood-forming centres continues for many weeks.

(*c*) Nutrition at this time is at its lowest ebb.

Worm control should be a normal routine practice on every property. As mentioned earlier, control consists of provision of adequate nutrition, drenching and pasture rotation.

It is a fact that if you spell a paddock for 3 weeks in summer, the numbers of barber's pole worm larvae are down to 10 per cent.

So, any form of rotation that spells pastures is a wise move.

Drenching is of two types. *Strategic drenching* is that drenching that must be done in relation to the time of the year. Thus calves should be given three strategic drenches each year in most involved areas of Queensland.

(i.) September–October. Spring drenching offsets the early build-up of barber's pole.

(ii.) December–January. Summer drenching attacks the peak parasite burden.

(iii.) March–April. Autumn drenching clears out the summer-acquired worms so that the stock enters winter and its poorer pastures with only themselves to feed.

Tactical Drenching is based on local environmental conditions. Should a fall of 1 in. of rain occur then the calves should be drenched 3 to 4 weeks later. The same applies when a cloudy humid spell occurs. When there is a period of rain, drenching every 3 to 4 weeks should be practised with a last drench being given 3 to 4 weeks after the termination of the raining spell.

Hookworm

Distribution.—This prolific blood-sucker is found in basically the same coastal and subcoastal areas as barber's pole worm but it is rare on the Darling Downs. Its distribution is not so widespread as barber's pole worm but given the right conditions it can be more severe. These "right conditions" are to be found in young stock (2 to 18 months) in humid, high rainfall areas. Set stocking can result in an explosive outbreak of hookworm disease. Dairy calves are often affected but beef calves seldom carry heavy hookworm burdens.

Life History.—This varies from that of barber's pole worm. Eggs are passed out and infective larvae develop in about a week. These larvae enter the new host by penetration of the skin or by ingestion. Whichever way they enter, they get into the bloodstream and soon lodge in the lung. Here they burst through the air-sacs, work into the wind pipe, are coughed up and then swallowed to the small intestine. There they mature and begin egg-laying. From ingestion until they reach the intestine involves about 1 to 1½ months and eggs are being produced at 2 to 2½ months. The adult worm is about ¾ in. to 1¼ in. in length.

Symptoms.—With hookworm disease, symptom are often explosive. In the younger calves (down to 2 months) deaths may occur suddenly. Other calves hang their heads, become dull, will not eat, breathe heavily (due to anaemia) and develop a severe diarrhoea. This diarrhoea is often black due to broken down blood in the calf's intestine. The worms suck in good blood, use the oxygen in it and then void the remainder. This is then broken down to a black iron substance.

"Bottle-jaw" is a common symptom in this disease. Constipation may be seen early but it soon gives way to diarrhoea. The anaemia is a major symptom in hookworm disease and this may be seen in the pale white membranes of the eyes and mouth.

Treatment.—Phenothiazine is *not* effective.

A phosphatic drench ("Neguvon") is very efficient in removing hookworm but *care must be exercised in its use.* To remove this parasite the drench must be used at the higher dose rate, which is 5 *grams of active drug per* 100 *lb. body weight of calf* (2½ grams per 100 lb. body weight is for barber's pole worm.) Since the "Neguvon" sloution is 62.5 per cent weight per volume this means that 2 c.c. of this solution contain 1¼ grams. Therefore 8 c.c. would contain 5 grams. The dose then is 8 c.c. of "Neguvon" solution per 100 lb. body weight of calf. Two points should be noted:

(*a*) The drug is never used in its concentrated form but it is always broken down with water. This is conveniently done to fit the drenching gun. For example a 200 lb. calf would require 16 c.c. of "Neguvon", which would mean adding the 16 c.c. of "Neguvon" to 44 c.c. of water. Total 60 c.c. or 2 fl. oz.

(*b*) To direct the drug to the fourth stomach and small intestine, a drench consisting of 2 oz. of 10 per cent. sodium bicarbonate solution should be given immediately before the "Neguvon" drench. The bicarbonate solution acts on the muscle layers inside the stomachs and directs the following drug straight to the fourth stomach.

The higher dose of "Neguvon" must be carefully measured and the weight of the calf must either be known or assessed accurately. Very poor calves tend to show toxic reaction to the drug and drenching these calves or over-dosing others can result in staggers, kicking at the abdomen, straining, coma and deaths. Over-dosing has caused serious losses. If there are any doubts or fears regarding treatment consult your veterinary surgeon, who carries the antidote for poisoning. The drug is an effective drench and just requires a little care.

Treatment should be allied with control to prevent re-infestation.

Control.—Steps here are largely as for barber's pole worm as far as stocking is concerned. No strategic drenching is necessary as the parasite is one of environment.

Avoid set stocking. Muddy calf pens are the thing a hookworm larvae likes best and should be avoided. Disperse calves. Graze them rotationally ahead of older stock. These steps plus phosphatic drenching will control hookworm.

Nodule Worm

This worm is a ¾ in. to 1 in. long parasite of the lower bowel. It is present in most cattle-raising areas and usually causes nodules of the gut wall with no real symptoms. If it gets a hold on a calf group, marked diarrhoea and wasting are seen.

Phenothiazine, once again, is the best treatment and the pasture should be changed together with drenching.

Hairworm

Plate 5

Hairworm; Natural Size.

Distribution.—This worm occurs chiefly in the south-eastern corner of Queensland and is found as less severe infestations on the Darling Downs, in the south-west and central-west. It is rare in the north.

Life History.—It is indeed a "hairworm," being ¼ in. to ⅜ in. long of cotton-thread thickness. It is found in the fourth stomach and small intestine of calves and young stock (up to 2 years).

The life history is almost identical with that of barber's pole worm.

Symptoms.—Infestation and nutrition are very closely related. This must be emphasized. For hairworm to become a concern, nutrition must deteriorate. Hence the acquisition of the worm in summer causes symptoms in winter.

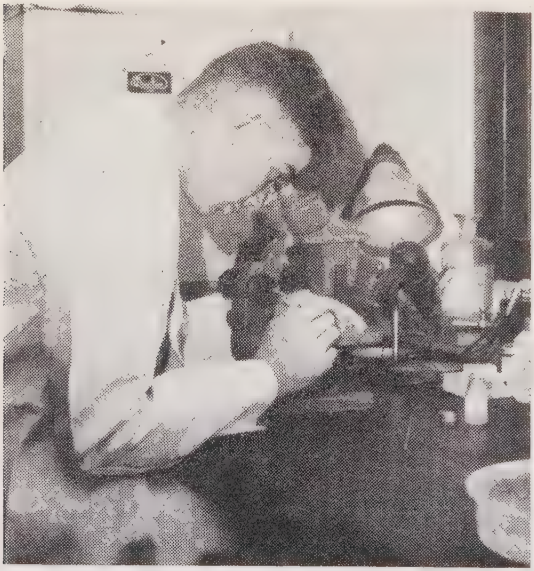


Plate 6

Egg Count and Egg Identification Being Carried Out by a Parasitologist in the Laboratory. This is a means of confirming a field diagnosis and identification of the parasites present indicates which treatment should be used.

Symptoms are not so spectacular as with barber's pole worm and hookworm. Affected calves stop growing, become very poor and develop a greenish-black scour of offensive odour. Affected animals may linger for weeks and then die.

Treatment and Control.—Phenothiazine is the most effective medicament available. Repeated drenching is often necessary. Probably more important than drenching, or at least of equal importance, is attention to nutrition. Efforts must be made to provide a higher plane of nutrition.

Cooperia species

This tiny worm (¼in. long) is distributed mainly along the coastal region and south-east. It is unlikely to cause trouble except in isolated cases. However, it frequently is present together with other worms (for example barber's pole) and therefore lowers the health of the animal involved.

Phenothiazine is *not* effective against this parasite but "Neguvon" gives excellent results as the lower dose rate (2½ grams per 100 lb. body weight). Control is as for hairworm.

Ostertagia species

The brown stomach worm, so called because it is usually coloured from the partly digested blood it ingests, is about ⅜ in. long, and is distributed over coastal Queensland, Darling Downs, the south-west and the central-west. This worm is not of great concern in Queensland but odd cases of infestation occur and cause anaemia, unthriftiness and deaths in calves.

Treatment and control would be as for hairworm since Phenothiazine gives very good results in the case of *Ostertagia.*

Trichuris species and *Nematodirus* species.

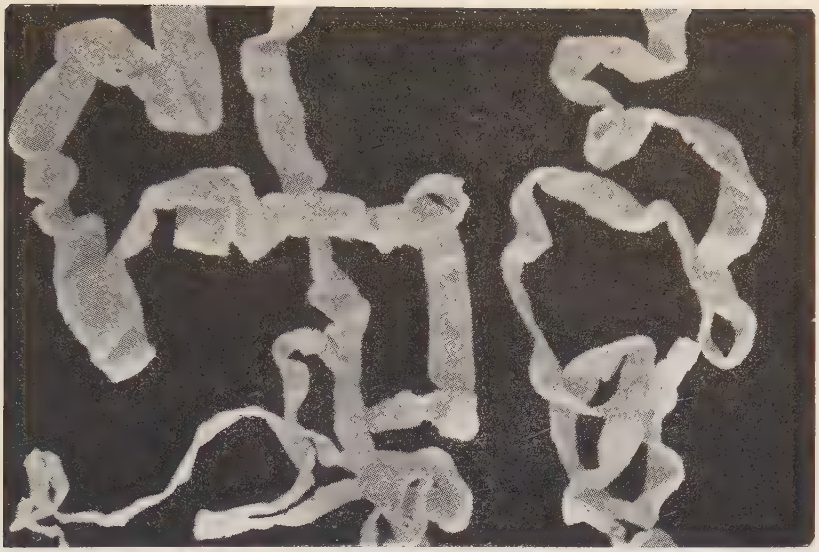
Neither is important.

2. **Lungworm**

The worm involved in cattle is known as *Dictyocaulus viviparus.* It is anything up to 3 in. long but only as thick as an ordinary pin.

Distribution.—The parasite is prevalent in dairy calves in coastal areas, especially to the south. Lungworm depends largely on seasonal conditions, hence it would be seen most in wet winters. Frequent outbreaks occur in winter when nutrition falls off and young stock tend to congregate at waterholes or follow gullies. At these sources the infestive lungworm larvae build up, and of course, their ingestion is much more likely. Lungworm larvae persist in *low temperatures* in *moist areas.*

Plate 7
Tapeworm.



Life History.—The adult worms live in the air passages of the lungs, and lay eggs. These eggs are coughed up and swallowed to the gut. By the time they leave the animal's intestine they have hatched to larvae. These larvae undergo changes and become infective larvae in as little as 1 week. Development depends on temperature. Grazing calves ingest the infective larvae which then pass via the bloodstream to the lymph glands of the intestine, back to the heart, and then on to the lungs via the blood once again. In the lungs, the larvae burst into the air sacs and then move on to the air passages (bronchi) where they become adults and begin egg-laying.

Symptoms.—As could be guessed from the life history, the main symptoms result from bronchitis and pneumonia. Parts of the lung may collapse. Coughing is a prominent symptom and badly affected calves lose condition and succumb. Secondary bacterial infection following lung damage frequently occurs and this can rapidly hasten death. The cough is variable. It may be slight; it may be harsh and continual.

Treatment and Control.—Over the last couple of years a new injectible drug for lungworm disease has made its appearance. It is now being used on many properties and results so far have been good. It has a complex name, cyanacethydrazide, and must be obtained on veterinary prescription. It is put up under different trade names for drenching or for injection.

Don't try to economise on the drug by modifying the directions. If instructions for use are followed, and if the pneumonia is a true lungworm pneumonia good results can be expected.

When treating, all affected calves should be given an injection on each of 3 consecutive days. Exposed calves running with affected calves but not showing symptoms should receive one injection on the day affected calves have their first injection. Good shelter, good food and freedom from intestinal parasites is necessary to effect a complete cure and reinforce the effect of the lungworm medicine.

Attempts to isolate the affected group from other groups, older and younger, should be made. Well-sheltered paddocks with good drainage should be used, if available.

3. Tapeworms

The following are the tapeworms present in cattle in Queensland:

Moniezia benedini
Moniezia expansa
Helictometra giardi

Distribution.—Tapeworms are found in coastal and subcoastal Queensland and on the Darling Downs. High rainfall areas feature more widespread tapeworm distribution.

Life History.—The adult tapeworm can be anything up to 20 ft. long and ½ in. to 1 in. in width. These segmented parasites attach themselves to the lining inside the small intestine. Infestations of only a few tapeworms are common. The adult worm becomes mature and fertile at the unattached extremity and egg-loaded segments continually break off from the worm and are passed in the animal's faeces.

Once out on the ground the tapeworm eggs depend on an *intermediate host* for transmission back to cattle. These intermediate hosts, *Oribatid* mites, are plentiful on pastures, where they feed on fungi, moss and decaying vegetable matter; hence ingestion of tapeworm eggs commonly occurs.

Inside the mite the egg hatches and then cattle accidentally ingest the mites. The young tapeworm is then released, attaches to the intestine and matures. The development of tapeworm eggs in the mite takes from 1 to 6 months depending on temperature. Six weeks after cattle ingest the young tapeworms, segments may be shed containing fertile eggs.

Symptoms.—Tapeworms do not cause much trouble. This may seem hard to believe when the size of the tapeworm is compared with that of the barber's pole worm.

However, large numbers of tapeworms must be present to cause any ill-effects such as unthriftiness and loss of condition. Parasitic symptoms in cattle are usually due to worms other than tapeworms.

Treatment.—If heavy infestations of tapeworms are causing trouble, treatment may be instituted. Lead arsenate, using 1·0 grams for calves and 2·0 grams for adults given by mouth, is the drug usually preferred.

4. **Flukes**

Two types of fluke are encountered in Queensland. The more serious one, liver fluke (*Fasciola hepatica*) has a relatively small distribution whilst the rather unimportant conical flukes (*Paramphistomum* species) have a widespread occurrence.

Liver Fluke

Distribution.—Two areas in Queensland are involved. One is the Stanthorpe-Warwick district, the other encompasses the Burnett, upper Mary Valley and the coastal side of the Blackbutt Range.

Life History.—The adult fluke is flattened and leaf-like, being about 1½ in. by ½ in. It is shaped like a small lantana leaf only a little more elongated. These flukes live in the bile ducts of the liver and lay their eggs there. The eggs enter the intestines with the bile and pass out in the animal's faeces. Outside, the eggs hatch in 1 to 4 weeks and the young forming liver fluke needs a certain type of snail to further its development. Hence conditions must be very damp. Inside this snail the developing fluke undergoes some changes until in 4½ to 7 weeks after penetrating the snail it leaves, again by penetration, and encloses itself in a cyst on a blade of grass. Cattle then eat grass and young encysted flukes together. In the animal's gut the young fluke emerges from its cyst, penetrates the intestinal wall and makes its way to the liver to reach the bile ducts. Here it matures and begins egg-laying.

Plate 8

Liver Fluke; Natural Size.

The complete life cycle is about 4 months.

Symptoms.—In Queensland fluke areas, the main losses are economic resulting from condemned livers.

Where symptoms do occur cattle show a constipation, wasting and dullness. Anaemia may be observed. The acute form, featuring sudden death, is not common.

Treatment.—Hexachlorethane is the drug for use in cattle against liver fluke. The dose is ½ oz. per 6 months of age with a maximum dose of 2 oz. Doses should be mixed individually as the drug does not suspend very well. Bulk mixing of doses has resulted in overdosing. Following treatment with hexachlorethane, animals may develop a foul-smelling scour and, in cows, the milk is usually tainted for two or three milkings.

Carbon tetrachloride can cause toxicity in cattle and should not be used in this species.

Control.—If control is necessary it is aimed at lraining marshy areas, regular hexachlorethane lrenches and provision of water sources so that nimals will not drink in areas where young ncysted flukes are.

Plate 9
Conical Fluke; Natural Size.

Conical Flukes or Ruminal Flukes

These flukes live as adults in the reticulum (first stomach) and sometimes in the rumen (second stomach). They are conical in shape and may be compared to a maize grain for size. Even heavy infestations do not cause symptoms but some scouring may result from the immature forms in the small intestine.

Treatment is hexachlorethane.

Worm Control in the Future

Research workers are at the present time engrossed in studies that could eventually lead to the production of a worm vaccine. X-ray techniques are being used to alter the make-up of a worm which may become harmless to the animal but capable of producing immunity. However, that is the future. For the present, think along lines of good husbandry versus worm control.

More Beef

(*Continued from page 558*)

windrows and burnt for £3. Stick picking or stick raking and burning will cost at least 30s. Total cost before the first ploughing is therefore £5 5s. Where there is heavy timber growing on creek or river flats, the cost of clearing and burning an acre may be closer to £10.

Initial ploughing costs £1 per acre.

It should be remembered that when a grazier clears country with his own plant, the job is generally done much cheaper than by contract. It is quite likely that the cost would be from 20 to 30 per cent. less.

Irrigation

Irrigation is very much in its infancy in the area. Up to date it has been confined mainly o those properties where there are good supplies of river or underground water.

Storage dams for irrigation are on the increase. One trial in the Taroom area has pointed to several feeding features that are involved in irrigation for beef cattle.

Carrying capacity at this trial has averaged between 1 and 3 head per acre. During the first 9 months of feeding, weight gains per day varied considerably.

One group gained only 1·2 lb. per day in the spring of 1958. The previous group of steers gained 2·4 lb. a day. The low gain was made when the pasture consisted mainly of lucerne with very little grass.

Other trials and local experience indicate that lucerne will not produce maximum gains when it is the only feed. Cattle on irrigated lucerne require adequate grass with the lucerne but preferably an adequate supply of grass or crop adjacent to the irrigation.

Well-managed irrigation is likely to carry an average between 1 and 2 head per acre per year. Weight gains are likely to average between 1·5 and 2 lb. per day per steer.

Some Promising Maize Hybrids For Atherton Tableland

By T. K. KELLY, Senior Adviser in Agriculture.

An annual check on the performance of maize hybrids is carried out in district trials on the Atherton Tableland, and results now indicate that some progress is being made towards the objective of a suitable hybrid for the area.

The difficulty on the Atherton Tableland is to find a hybrid with sufficient resistance to disease. Climatic conditions in the district both up to flowering and during the period of maturity are very favourable for the development of fungal diseases.

For many years the major diseases have been cob, stalk and root rot caused by *Diplodia zeae, Gibberella zeae* and *Gibberella fujikuroi.* In the 1958-59 season another important disease appeared in the form of tropical rust, *Puccinia polysora.* Two other diseases which are widespread and assuming importance are brown spot, *Physoderma zeae maydis,* and leaf spot, *Diplodia macrospora.*

There are other maize diseases of secondary importance on the Tableland such as common maize rust, *Puccinia sorghi;* leaf blight *Helminthosporum turcicum,* and secondary cob rot, *Nigrospora oryzae.*

Until recent years the local open-pollinated maize in this district, known as Atherton Dent or Atherton Main Type, could outyield all hybrids whether they were from Gatton, Grafton or New England.

The Atherton maize is not a fixed variety but is a miscellaneous mixture of dent types. The cob and grain reveal the influence of the variety Fitzroy.

Another variety known as Durum and of flint origin is grown to a limited extent but in district trials has been inferior to Atherton Dent.

Trials since 1956 show in Table 1 that two Grafton-bred hybrids, GH128 and GH327, have consistently outyielded the local open-pollinated variety.

In a year in which there is little disease, hybrids such as GH188, GH170 and Ensign are capable of high yields but they fail in a normal year.

Testing of Parents

Apart from the testing of available double cross hybrids, a range of single crosses and inbred lines has been tested since the 1957-58 season. Inbred lines which have given the best results over the last 3 years are 13A, M1, Y1, 68, M16 and 61B.

The testing of parental material gives a valuable guide to the plant breeders at Grafton and Gatton for subsequent combinations. In addition, it has revealed the parents from which hybrids such as GH128 and GH327 are obtaining their desirable characteristics for Tableland conditions. An example of the importance of rentage and the need for testing was indicated the 1958-59 season when cob rot was very valent. In the single cross trial, Y1 x M1, a ent of GH128, gave a yield of 48 bus. to the e while three adjoining single cross hybrids der test for the first time gave yields of 0, and 8 bus.

During the current season, eight double cross brids, 25 single crosses and 17 inbreds from afton together with 21 single crosses and 37 inbreds from Gatton are under trial on a district farm. This particular farm and trial area, which has been used since 1956-57, has grown maize continuously for many years and provides an ideal testing ground for disease resistance.

An interesting hybrid under test for the first time is GH378 (Y1 x M1) (13A x 68). It will be seen that this hybrid has been made up from four of the best inbred lines tested on the Tableland.

TABLE 1

Yield of Grain in Bushels per Acre of Double Cross Hybrids and Atherton Dent

Hybrid or Variety	Season				Average last 3 years	Average last 4 years
	1956–57	1957–58	1958–59	1959–60		
I128 (Y1 x M1) (23 x 25) ..	45·3	37·3	37·1	41·7	38·7	40·3
I327 (13A x TX203) (68 x M1) ..	..	31·5	34·7	42·9	36·4	..
herton Dent (Open-pollinated) ..	36·3	24·8	23·8	34·1	27·6	29·8

In Table 2 it will be seen that the leading brid GH128 has no superiority over Atherton ent in relation to disease resistance. Field servations indicate that the hybrid is more sceptible to Diplodia but has greater resistance Gibberella cob rot. The yield advantage ined by GH128 has been mainly as a result of b uniformity, less barren plants and less dging.

TABLE 2

verage Percentage of Diseased Cobs, Barren Plants and Lodging over the Three Year Period 1957/58–1959/60

——	Diseased Cobs	Barren Plants	Lodging
H128	15·4	7·6	1·7
H327	8·5	10·6	3·5
herton Dent ..	15·5	14·1	5·7

Many other hybrids have been under test in ese experiments but are not listed in Table 1 cause of poor yields or a lack of consistency.

About 20,000 acres of maize are grown annually on the Atherton Tableland. Five years ago the area of hybrid maize was 2 per cent. of the total. In the 1960-61 season, hybrid maize constituted 45 per cent. of the acreage.

While this is indicative of the farmer-interest in hybrid maize, it must be emphasised that the best available hybrids for this area remain far short of requirements.

In Table 2 it is shown that GH128 can give a crop loss of 25 per cent. as a result of diseased cobs, barren plants and lodging. The lodging attributed to GH128 is mainly the result of stem rots and not from a weak root system.

Two Main Approaches

There are two main approaches to raising maize yields on the Atherton Tableland:

The first is a maize breeding and testing programme which will provide disease resistant hybrids with yielding ability superior to existing available types.

The second is to restore soil fertility to enable better hybrids to reach their yield potential.

A Chart To Help You Find Defects In Milk And Cream

By J. ARMITT, Experimentalist, and K. FITZGERALD, Dairy Officer.

The advent of milking machines, engine-driven and electric motor-driven separators and the farm refrigerator has allowed great advances to be made on the dairy farm. These advances have meant greater mechanisation in the dairy with corresponding reduction in labour requirements.

But like any new advances they have also brought with them problems which have meant changes in the approach to dairy hygiene and maintenance, and in some cases complete changes in the techniques used.

A "Defect Finding Chart" has been prepared to assist dairymen to pinpoint causes o defects in their products or machinery and hel them to overcome the majority of the problems.

In an article of this type it is only possibl to set out the major problems and recommendations, and if you have not found the troubl after checking through this chart, contact you local dairy officer, who will be only too willin to assist you.

Plate 1: Pressure Spray Washing Provides Effective Cleaning and Stimulation.

DEFECTS IN MILK AND CREAM

DEFECT	PROBABLE CAUSE	RECOMMENDED ACTION
ort methylene blue eduction time ; off lavour ; sour ; ermented ; cheesy	Contamination from equipment and utensils	1. Ensure that milking machines and utensils are free of milkstone, thoroughly clean and sterilized 2. Pay particular attention to rubberware, claws, sight bowls, releaser, buckets, coolers and cans 3. Use chlorine sterilizer solution as pre-rinse 4. The acid-alkali type cleansers are recommended—use according to makers' recommendations 5. Brush plant regularly, using nylon brushware 6. Ensure that for final rinse of machines and equipment BOILING WATER is used 7. Ensure that rubberware is kept in good order, changed regularly and boiled in caustic solution weekly (1 tablespoon to 4 gal.)
	Dirty cows-dirt on flanks or udders or dust from manure, soil or feed in yards or bails	1. Ensure that yards and surroundings are free of manure 2. Provide 30 ft. stock-free area around milk room 3. Rinse machines and utensils with a chlorine solution (200 ppm) prior to milking. This solution can then be used for an udder wash 4. Wash cows' udders free of manure or dirt before milking 5. Use cotton wool filter pads in strainer
	Inclusion of aged or stale milk Mixing hot and cold cream	1. Do not include milk from cows which are very late in lactation as this milk tends to be salty or bitter 2. Ensure that hot and cold cream are not mixed. Allow each separation to cool prior to mixing with previous separation. Stir well
	Faulty cooling	1. Where refrigeration is practised, ensure that it is operating efficiently 2. Use floating dairy thermometer (obtainable at factory) to check milk temperature at cooler and in refrigerator 3. Where refrigeration is not practised for cream supply, ensure that cream is placed so that it can cool as quickly as possible
	Use of contaminated water	1. Use tank water in preference to hard water for dairy cleaning 2. Storage tanks at bails should be screened and cleaned regularly 3. Ensure that water is boiling at all times before use 4. To water used as pre-rinse of machines and utensils add a sterilizing compound
	Inclusion of milk from cows affected with mastitis	1. Check cows regularly for mastitis with strip cup 2. Milk affected cows last and do not include their milk with the bulk 3. Treat affected cows and do not include milk until 3 days after treatment is concluded 4. Use a chlorine pre-rinse and udder wash to minimise the spread of mastitis
	Faulty handling methods	1. Ensure that all milk and cream is placed in clean, sterilized cans 2. Stir cream regularly 3. Regulate fat test of cream to 34%–38% in winter and 38%–42% in summer 4. Cover cream with gauze cream can covers 5. Forward milk and cream to the factory as regularly as possible
llowy or oxidised	Exposure of milk or cream to direct sunshine	1. Ensure that cream is not placed where it can be affected by direct rays of the sun

DEFECTS IN MILK AND CREAM—*continued*

DEFECT	PROBABLE CAUSE	RECOMMENDED ACTION
Tallowy or oxidized	Placing milk or cream in cans and leaving the cans in the sun Leaving cans of milk or cream in the sun at the roadside prior to pick-up. Cream with an excessively high fat test	2. Ensure that cream is shaded at the roadside (roadsi shelter) 3. Ensure that cans are cool before being filled 4. Regulate fat test to 34%–38% in winter and 38%–42 in summer
Feed flavour	The following feeds can cause "feed" flavour : Lucerne Clovers Medics Cereal crops	1. Put cows on these crops immediately after milking an complete grazing at least 3 hours before next milkin (This practice is essential in the case of lucerne, clove and medics) 2. In the case of night's milk for the market milk trac stirring prior to delivery to the factory will assist great
Weedy	Wild carrot Cress family Mustard Hexham scent Wild turnip Fish weed	1. Once cream is affected with weed taint it is impossib to remove it 2. As a long-term measure, the improvement of pasture will help to minimise weed taint 3. Removing cows from weed affected pastures at leas 5 hours before milking will help to minimise weed tain
Absorbed flavour	Absorbed flavour can be caused by milk or cream coming in contact or being stored near the following— Kerosene or diesel fuel, onions, garlic, &c. Smoke. High smelling foods such as fish	1. Do not store milk or cream near any substance whic has a pungent odour 2. Make sure that utensils are not contaminated with an substance from which the odour may be absorbed 3. Do not allow cows access to onions or garlic tops, &c 4. When handling these substances make sure your hand are free of the odour before milking or handling mil or cream 5. Make sure that engine fumes or fire smoke are no blowing into milk room or diary where milk or crea is handled

10 Aids To Top Quality Milk And Cream

1. Healthy, well-fed stock.
2. Abundant and pure water supply at the milking shed.
3. Adequate supply of BOILING WATER for cleaning and sterilizing purposes.
4. Clean, sterile machines and utensils.
5. Milking clean udders in clean bails, using clean hands.
6. A means of cooling milk and cream as quickly as possible.
7. Nylon brushware, used regularly and kept in a clean condition.
8. Sufficient supply of cleansers used at the maker's recommendation.
9. Clean udder wash cloth used with a chlorine solution.
10. Dust and manure free bails, yards and surroundings.

If any particular problems are experienced in regard to milk and cream quality, contact your local dairy officer, who will make arrangements to visit you and discuss the matter.

MILKING MACHINE FAULTS

DEFECT	PROBABLE CAUSE	RECOMMENDED ACTION
pparent slow milking or failure to milk out completely	1. Insufficient or faulty stimulation of cows prior to milking 2. Continual hand stripping 3. Slack inflations 4. Low or unsteady vacuum at cups due to— (*a*) Faulty vacuum pump (*b*) Faulty vacuum control valve (*c*) Air leaks 5. Leaking or blocked pulsators or air lines	1. Thoroughly wash and massage cows' udders for 30 sec. prior to milking. During this time check cows for mastitis with a strip cup 2. Train fresh cows to strip by machine 3. Ensure that inflations are in good order and have the correct tension 4. Ensure that vacuum control valve is clean and not worn. Replace if faulty. Check for air leaks, paying particular attention to connections, flaps and rubber plugs 5. Ensure that slide pulsators are clean (not blocked or worn) and smeared lightly with water-resistant light chassis grease 6. If trouble continues, ask your local dairy officer to test your machine with the Ruakura Testing Equipment
ups fall off	1. Quick let-down in high-producing cows 2. Inflation too slack or too tight 3. Faulty vacuum control valve 4. Worn vacuum pump, incorrect adjustment of pulsators, faulty vacuum gauge	1. With high-producing cows that milk out quickly, hold the cups on until the first flush of milk has gone 2. Keep inflations in good condition and at the correct tension 3. Ensure that vacuum control valve is clean and not worn. Replace if faulty 4. Have local dairy officer test milking machine
ilk or milky water in vacuum tank	1. Faulty releaser flaps 2. Blocked releaser pulsator or tube to pulsator 3. Air leaks in releaser 4. Flushing several units simultaneously 5. Cracked inflations	1. Replace worn releaser flaps 2. Ensure that pulsator or tube is not blocked 3. Make sure releaser flaps seal adequately and all other joins are airtight 4. Do not flush too many units at the one time ; this floods the milk line and releaser 5. Check for cracked inflations

10 Aids To Efficient Machine Milking

1. Ensure that cows are sufficiently stimulated (30 sec.) prior to milking.
2. Train cows to machine strip.
3. Maintain rubberware on machines in a clean and satisfactory condition, and inflations at the correct tension.
4. Keep pulsators clean and in the case of slide type lightly smeared with water-resistant light chassis grease.
5. Keep vacuum pump well oiled and use only recommended vacuum pump oil.
6. Ensure that all belts are in good condition and kept at their correct tension.
7. Ensure that releaser flaps are in a good condition.
8. Ensure that the vacuum control valve is in good condition.
9. Regularly check machine for air leaks.
10. Milk at the vacuum recommended by the makers of the machine, and have the vacuum gauge regularly tested.

If you consider that your milking machine is not operating as efficiently as it should, ask your local dairy officer to check it with the Ruakura Air Flow Meter and Vacuum Recorder. He will then be able to advise as to what action should be taken to place the plant in efficient running order.

FAULTS IN SEPARATION

Defect	Probable Cause	Recommended Action
Unusual mechanical noise	1. Worn bearings	1. Ensure that separator is lubricated correctly
	2. Bowl out of balance	2. If bearings are badly worn a new machine may be necessary
	3. Irregular driving power	3. Check balance of bowl by examination when running, and have rebalanced if necessary
		4. Check condition of engine, counter shaft, pulleys and belting
Cream too thick	1. Incorrect cream or milk screw adjustment	1. Adjust screw to correct test. One turn of *cream* screw anti-clockwise will reduce test approximately 2%. To reduce test, *milk* screw is turned clockwise
	2. Insufficient milk in bowl	2. Adjust flow to capacity of separator
	3. Tube from float to bowl restricted	3. Remove burr from inner edge of end of feed tube
	4. Bowl driven too fast	4. Check speed and adjust to that recommended for machine
	5. Milk too cold when separated	5. If milk too cold add a little boiled water at 200°F. It may then be necessary to adjust cream or milk screw as well
Cream too thin	1. Cream or milk screw out of adjustment	1. Screws adjusted in opposite direction to above
	2. Bowl drive not fast enough	2. Check speed and adjust to that recommended for machine
	3. Bowl too high	3. Adjust height of bowl
	4. Too much milk admitted to bowl	4. Adjust flow to separator by adjusting vat tap height above float, and when vat is full only partly open tap
Loss of cream in skim-milk	1. Bowl drive not fast enough	1. Adjust speed of bowl. Check speed of handle shaft, using a watch
	2. Bowl too low	2. Adjust height of bowl
	3. Too much milk admitted to bowl	3. Adjust rate of feed of milk (see Cream too thin, No. 4)
	4. Bowl out of balance	4. Have bowl rebalanced
	5. Worn conical plates, distributor, or false top or other internal bowl parts	5. Have bowl reconditioned
	6. Cracked cream spout	6. Repair cream spout
	7. Milk too cold when separated	7. Warm the milk (see Cream too thick)
	8. Dirty bowl	8. Dismantle and clean bowl after ½ hr. running
		9. Strain milk before separation
Leaky bowl	1. Faulty rubber ring	1. Replace a faulty rubber ring
	2. Loose locating pin or bottom plug in the bowl	2. Have bowl reconditioned
	3. Bowl too low	3. Adjust height of bowl
	4. Cracked skim-milk spout	4. Repair milk spout
Excessive bowl wobble	1. Faulty rubber ring	1. Replace rubber ring
	2. Bowl and associated parts worn	2. If bowl worn, have it reconditioned
	3. Bowl riding on spindle instead of seating correctly	3. Check seating and if necessary have new spindle fitted and bowl reconditioned
	4. Insufficient number of dishes in bowl	4. Add one or two dishes
Whole milk gushes from the cream spout	1. Gassy milk—due to cows on fresh succulent pastures (common in springtime)	1. Extend the feed tube from the float chamber so that it reaches well down into bowl
	2. Trying to force too much milk into the bowl	2. If necessary adjust supply of milk to bowl

10 Aids To Efficient Separation

1. Keep separator in good mechanical condition and correctly lubricated.
2. Keep bowl and allied parts in good condition and if necessary have bowl reconditioned and rebalanced.
3. Keep engine, shafting, pulleys and belting in good condition and maintain belting at correct tension.
4. Separate at correct speed.
5. Maintain milk flow at that recommended for machine.
6. Separate with milk at correct temperature.
7. Adjust bowl to correct height.
8. Clean and sterilize separator after each separation.
9. Adjust cream test to 34%–38% in winter and 38%–42% in summer.
10. Instal a separator large enough to treat all the milk in three-quarters of an hour or less.

If trouble is experienced which you cannot remedy yourself, have your local dairy officer or maker's representative check the separator.

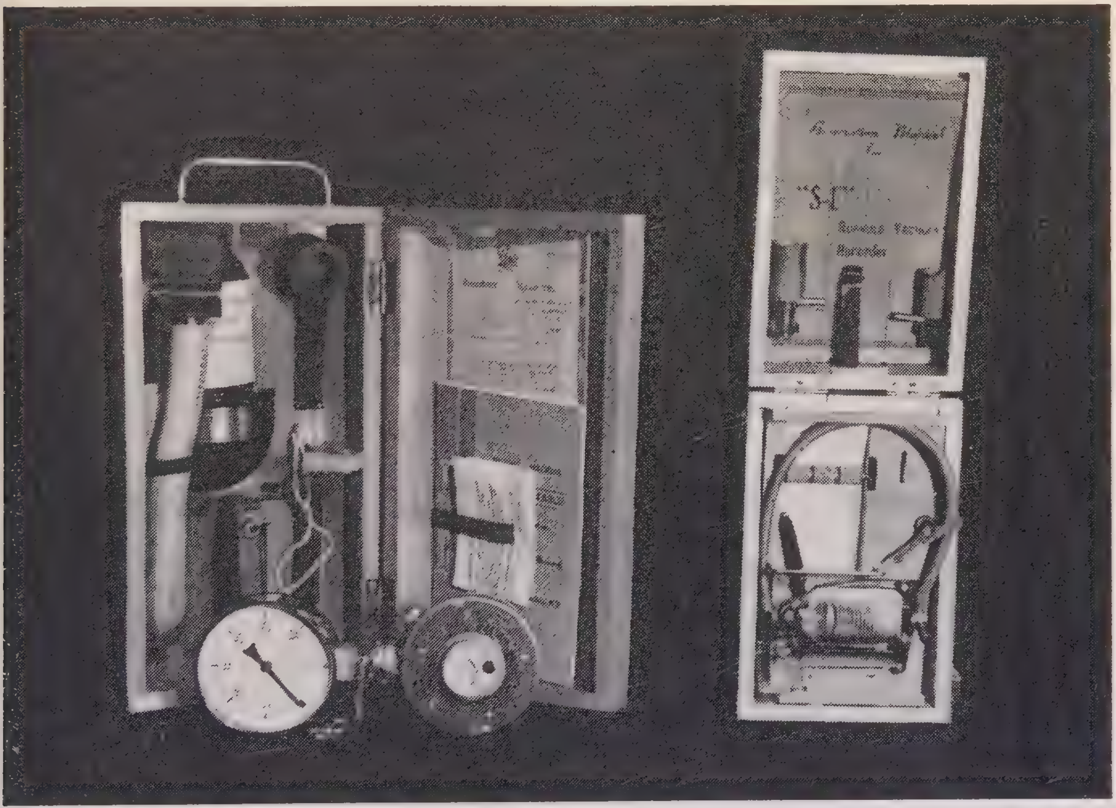


Plate 2: **Milking Machine Testing Equipment.** On the left, the air flow meter for testing vacuum pumps, relief valves, gauges and air leaks. On the right, a vacuum recorder for testing and adjusting pulsators.

REFRIGERATION FAULTS

Defect	Probable Cause	Recommended Action
Refrigerator runs for excessive time	1. Low gas charge	1. Have refrigeration mechanic check unit for leaks, and recharge with gas
	2. Refrigerator overloaded	2. Partially cool the milk over an atmospheric water coole or section of cooler
	3. Insufficient water in immersion type cabinet	3. Maintain correct level of water in immersion type cabinets
	4. Valves closed or at incorrect position	4. Check position of hand-operated valves
	5. Insufficient ventilation around unit (compressor)	5. Ensure that compressor has a free draught of air passing around and through it
	6. Faulty rubber seals on upright cabinets (allowing cold air to escape)	6. Replace any faulty rubber seal
Milk leaves cooler at too high a temperature	1. Cooler too small or milk flowing over cooler too fast	1. Adjust milk flow so that cooler is just covered with milk. Use a cooler of correct capacity for size of refrigerator
	2. Gas charge in unit too low	2. Have refrigerator checked by refrigeration mechanic
	3. Blocked cooler pipes, strainer or pump	3. Check that there is no blockage throughout system
	4. Insufficient water in immersion type cooler	4. Maintain correct water level in immersion type plants
	5. Refrigerator of too low a capacity to cool all milk efficiently	5. Have a refrigerator large enough to treat all milk effectively
Cans rusting in water immersion type cabinets	1. Water contaminated with foreign matter	1. Change water regularly and keep it free of foreign matter. Keep outside of cans clean and wipe down before placing in refrigerator
	2. Build up of acidity in water	2. Keep water slightly alkaline by addition of small quantity of alkali (see 7 below)
	3. Exposed base metal on outside of cans	3. Keep cans well tinned both inside and out

10 Aids To Efficient Refrigeration

1. Have a refrigerator of sufficient capacity to efficiently treat all the milk.
2. Use a shock cooler of sufficient capacity for the quantity of milk produced.
3. Adjust the milk flow to the correct rate for the size of cooler. (Cooler should be no more than covered with milk.)
4. Maintain the unit and cabinet in good condition. (It is recommended that a refrigeration mechanic check the unit at least once a year.)
5. Allow sufficient ventilation around compressor.
6. In water immersion type units maintain water at the correct level and change regularly.
7. In immersion type units maintain alkalinity of water. (This can be accomplished by one teaspoonful of caustic soda, soda ash, &c.)
8. Check water regularly for alkalinity by adding one drop of phenolphthalein solution (obtainable at butter factories) to a teaspoonful of water. A faint but definite pink colouration indicates the correct degree of alkalinity.
9. Store only milk or cream in sections specified for dairy produce.
10. Check temperatures of milk leaving cooler and in refrigerator by means of a floating dairy thermometer (obtainable from your local factory).

If trouble is experienced which you cannot remedy yourself, consult your local dairy officer or manufacturer's representative.

Queensland Fauna Sanctuaries

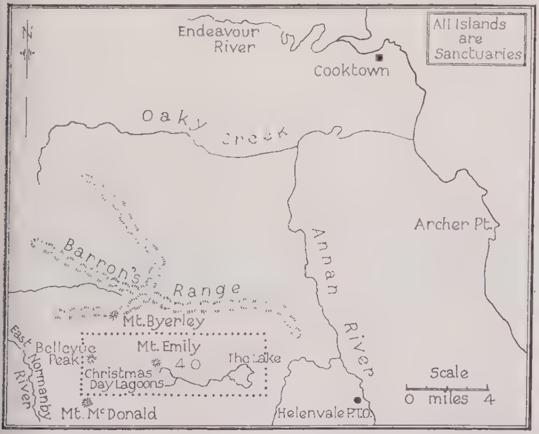
By C. ROFF, Fauna Officer.

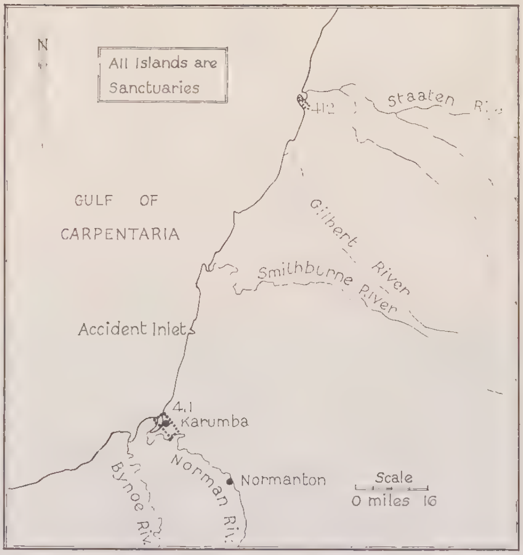
The following is an index to the sanctuary utlined in Map 33:

Index No.	Sanctuary	Area in Acres
410	" Kings Plains," via Cooktown	16,953

The following is an index to the sanctuaries utlined in Map 34:

Index No.	Sanctuary	Area in Acres
411	Air Base and Pilot Station, Karumba	9,942
412	Pelican Rookery, Staaten River, VanRook Holding	1,740


N
Endeavour River
Cooktown
All Islands are Sanctuaries
Oaky Creek
Archer Pt.
Annan River
Barron's Range
Mt. Byerley
East Normanby River
Bellevue Peak
Mt. Emily
40
The Lake
Christmas Day Lagoons
Mt. McDonald
Helenvale P.O.
Scale
0 miles 4


N
All Islands are Sanctuaries
412
Staaten Riv.
GULF OF CARPENTARIA
Gilbert River
Smithburne River
Accident Inlet
411
Karumba
Norman Riv.
Bynoe Riv.
Normanton
Scale
0 miles 16

Map 33 (left): **Map Showing Sanctuary in Part of Fauna District No. 6.** The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines enclosing the stippled areas.

Map 34 (top): **Map Showing Sanctuaries in Part of Fauna District No. 6.** The sanctuary boundaries (as at December 31, 1957) are delineated by dotted lines enclosing the stippled areas.

Graziers Find Stability In Silage

A fodder reserve of silage does not only cut stock losses in a drought; what is even more important, it permits a stable, increased stocking rate on a property.

This is the view of successful realists, graziers F. W. and C. Lee, of "Coomoomie" in the Glenmorgan district.

Their 20,000 acre property in a 22-inch rainfall district carries a flock of Merino breeders and a Corriedale stud.

The Lee family learnt the value of fodder conservation the hard way. Heavy losses in the 1946 drought showed them forcibly that without stored fodder of some sort they could not hope to maintain their stud Corriedales and increase their Merino flock.

Unlike many farmers and graziers in Queensland, they did not forget or shelve their resolutions once the drought broke. Instead, they set about building up a fodder reserve. This took the form of baled oaten and wheaten hay and silage made from sweet sorghum.

Today, the Lee family has built up a reserve of 2,500 tons of sorghum silage, stored in a number of 200-ton earthen trenches. It is there, safe and secure, ready to meet any emergency.

About 2,200 acres of their property are now under cultivation. Of this, 600 acres are under improved pastures. The Lee family grows 1,200 acres of oats and wheat for winter grazing, and 400 acres of summer crops. The summer crops are used for both grazing and silage.

In the 1957-58 drought, 800 tons of silag and 6,000 bales of hay were fed out to 7,00 sheep. These were mainly the Merino ewes an stud Corriedale portions of the whole flock.

The 1960 drought found the Lee family feeding sweet sorghum silage to 3,000 lambing ewes In three months until last November's rain brought relief, 450 tons of silage were fed.

Mr. Claude Lee said his experience in th lower-rainfall area led him to prefer silage t hay as a stored fodder. Wheaten and oat hays were not a good economic investmen mainly because of wastage and deterioration quality in storage between dry spells.

He said the only baled hay that would be mad on "Coomoomie" in future would be from surpl improved pasture. It had been found th pastures of green panic, Gayndah buffel an lucerne made excellent hay that was relished b sheep, cattle and horses.

Mr. Lee said experience over the years ha proved silage to be the most economical approac to drought feeding on "Coomoomie". Harveste with a cutter-bar forage harvester and made fro a high-yielding crop like sweet sorghum, it cou be stored cheaply without much waste. Th silage could be fed out with a minimum labour.

The long-term success of silage o "Coomoomie" is worth the attention of ever farmer and grazier faced with the alternative of either understocking or risking serious stoc losses in a drought.

This article was compiled from a report b R. G. Wilson, Adviser in Agriculture at Toowoomb

Plate 1

This Mixed Pasture of Gayndah Buffel, Lucerne and Barrel Medic on "Coomoomie," Glenmorgan District, Stretches Away Into the Distance. It is part of 600 acres of improved pastures on the property. Further plantings are planned. The sowing rate is: Gayndah buffel 2 lb. an acre, lucerne 1 lb., and barrel medic ½ lb.

Plate 2

Improved Pastures Make a Useful Contribution to the Fodder Conservation Programme on "Coomoomie." Surplus pasture is baled and then fed back to the stock in a dry time to supplement silage, also conserved on the property. Pasture hay from stands of green panic or buffel grass with lucerne and barrel medic is relished by sheep, cattle and horses.

Tuberculosis-Free Cattle Herds

(As at 9th August, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale, via Wondai
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Littleton, H. V., "Wongalea", Bowenville
Maller, W., Bore View Past. Co., Bore View, Pickanjinnie
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755 Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin, via Kingaroy
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
O'Sullivan, P. W., "Navleigh", MS 371, Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boon

Ayrshire

Dudgeon, Est. C. E. R., Marionville, Ayrshire Stud, Bald Knob, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L., "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Offi Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., Conondale Rd., Maleny
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah
Superintendent, Marsden Home for Boys, Station Rd., Nth. Bo

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Bonnah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton
Wilson, J. R., "Okeden", Proston

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., Craigan Jersey Stud, Aspley, Brisbane
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, I. S., "Brooklands" Jersey Stud, Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H.M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M. & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Angel, W. D., "Summerhill", Murgon
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Pellet Your Buffel Seed And Thwart Ants

B. R. CHAMP, Research Entomologist, and D. I. SILLAR, Agrostologist.

In many Queensland districts, the control of ed harvesting ants is an important factor in ccessfully establishing stands of buffel grass d other sown pastures. These small brown ts harvest the seed before germination, and ke it to their nests where it is either eaten or ored for future food requirements.

In inland areas it is advisable to establish buffel ass by the following means: Plough colonisation rips 6 ft. wide and 1 chain apart with an implement such as a chisel plough equipped with veeps; then broadcast pelleted seed over the oughed strip just before the wet season.

The grass, established in the colonisation strips, radually spreads and covers the intervening reas.

Pelleting may be done by farmers and graziers n their properties. *Mix thoroughly* 200 *parts by weight of basic superphosphate with* 1 *part by weight of* 10 *per cent. lindane dispersible powder. Gradually add the fertilizer-insecticide mixture to* 40 *parts by weight of seed which has been wetted with* 0·25 *per cent. detergent solution. Mixing may be done in a cement mixer, barrel, or similar device. Spread the seed to dry after it has taken up all the fertilizer-insecticide mixture.*

Handle pelleted seed carefully, or some of the pelleting material will be lost. Seed must be planted as soon as possible after drying.

In *subcoastal districts,* where areas to be planted are less extensive and land preparation can be more intense, pelleting will not be necessary and a seed dressing is satisfactory at the rate of 3 oz. of 10 per cent. lindane dispersible powder per bushel applied to dry seed before planting.

Plate 1

A Thriving Stand of Buffel Grass in the Cloncurry District.

Brucellosis-Tested Swine Herds (As at 9th August, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilston Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., 225 West St., Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains," M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Baker, R. L., "Baroma", Glenapp, via Rathdowney
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J. Plunkett Rd., via Tamborine
Campbell, J. W., "Bunya", Bell
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Coulsen, B. L. R., Wondai
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
Glasser, D. H., "Yagaburne", Goondiwindi
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Hickson, K. L., "Warree", Tableland Rd., Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, MS74 Clifton
Horton, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law. D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Rosevale, via Rosewo
Mack, A. J., "Culzean", Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P. & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Pigger Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Sedgwick, F. G. & J. E., Mundubbera
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Farm For Boys, "Canaan" Stu Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Cooper, G. J., Neumgua
Coulson, B. L. R., Wondai
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn", M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale". Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzean", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Alexander and Lundie, "Vanda", Biddeston
Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Burnett, E. V., "Glenden", Tabooba, via Beaudesert
Carmichael, D. J., & J. P., "Junelea," Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Coulson, B. L. P., Wondai
Coulson, Mrs. H. M., Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crawford, R. J. and Sons, "Inverlaw", Kingaroy
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla," Killarney
Hickson, K. L., "Warree", Tableland Rd., Calliope
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jarvis, O., Wondai
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., 225 West St., Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Nielsen, B. J., "Glen-View," Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton," M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Port Curtis Co-op. Dairy Assn. Ltd., Stud Piggery, Biloela
Powell, R. S., "Kybong", Gympie
Radel, R. M. "Turua", Coalstoun Lakes
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young, R. & C., "Dudley Park", Biggenden

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Wheat Quality At Different Maturity Stages

y W. T. KELSO, Chief Chemist (formerly Senior Cereal Chemist), and
. BYGOTT, Experimentalist.

Weather conditions affect the protein content wheat by controlling the yield and plumpness f the grain. Its effect on protein quality is not enerally known. It has been found in the laboraory that heat treatment of flour increases its rength to the detriment of quality, and that ronger flours are affected more than weaker nes. Therefore one would expect that relatively ool, moist conditions would be the most favourble for good protein quality. Also that hot, dry onditions, on the other hand, which accelerate rowth, would be expected to produce overstable rotein quality, and that this would occur mainly n the hard strong wheats, represented by Festival nd Charter.

In the field and laboratory trials. Festival and pica were selected, Festival being a physically ard grain with strong to very strong quality and pica, a medium to soft grain, with strong to very trong quality. Both varieties produce a high rotein content, with Festival showing a strong endency to produce a flour quality inferior to pica. Because of its high quality, Spica is the tandard with which all other wheats are comared.

The experiment was carried out in the years 957 and 1958, at the Regional Experiment tation, Hermitage, on the south eastern Darling Downs under the direction of the Department's gricultural Chemical Laboratory, in association vith the Regional Experiment Station staff. The irst harvesting of the whole plant took place vhen the grain moisture level was between 41 and 7 per cent. The plants were then dried in the shade and subsequently threshed. Similarly, the second plant harvest occurred when the grain moisture level was between 13 and 24 per cent. The final harvest was made with the header when the plants were at maturity (10 per cent. moisture).

Weather Conditions from Flowering to Maturity

Relevant weather data (monthly averages) for the October-November period for the 2 years in question were recorded.

It was seen that during the relevant months in 1957, the maximum temperatures were above average and the humidities below average. These factors, combined with lower rainfalls, would cause a rapid ripening of the grain. Apart from an early hot and dry period late in October, weather conditions during crop maturity in 1958 were generally more humid with a higher rainfall. Maximum temperatures were lower than the preceding year. These moist conditions extended the time from flowering to crop maturity to 51 days, compared with only 34 days in 1957. Rainfall during the respective periods varied from 1 in. in 1957 to 4 in. in 1958.

The protein contents for 1957 were uniform for both varieties at the three harvest times. Variation occurred in 1958 between harvest times and between varieties, Festival being the higher. The higher protein contents during 1958 would result from the much lower bushel weights in that year compared with 1957.

TABLE 1

Protein Content (at 13·5 Per Cent. Moisture) and Bushel Weight

—	Spica		Festival	
	1957	1958	1957	1958
1st Harvest	14·7	13·9	14·1	15·3
2nd Harvest	14·9	14·9	13·8	16·8
Final Harvest	14·3 (66)	15·3 (59)	14·2 (68)	16·6 (59)

Bushel weights are shown in lb. in brackets.

Flour yield for 1957 was fairly constant for each of the varieties and this indicates the advanced stage of the grain at the first harvest. The situation was quite different in 1958 when increasing values were obtained in each of the harvests for both varieties. The earlier harvests indicate lack of maturity. The 1958 season was such that the grain received natural conditioning in the field. Grain in this physical state is easier to mill when compared with grain artificially conditioned in the laboratory. Conditioning is a prerequisite to milling, which involves moistening the grain (with or without heat). This procedure facilitates the removal of the various grain fractions in the milling process.

TABLE 2

Flour Yields (%)

—	Spica		Festival	
	1957	1958	1957	1958
1st Harvest . .	71·8	67·4	67·8	63·5
2nd Harvest . .	72·6	73·8	67·9	69·7
Final Harvest . .	71·2	75·0	66·9	72·3

Flour Quality

All the flours from the wheats were tested for quality. This involved physical testing and the baking test. The results are summarised in Table 3.

TABLE 3

1957	Strength		Quality	
	Spica	Festival	Spica	Festiva
1st Harvest . .	strong	medium strong	very high	fair
2nd Harvest . .	very strong	medium strong	high	fair
Final Harvest . .	exceptionally strong	medium strong	high	fair

1958	Strength		Quality	
	Spica	Festival	Spica	Festival
1st Harvest . .	weak	weak	fair	poor
2nd Harvest . .	strong	very strong	very good	good
Final Harvest . .	very strong	very strong	exceptional	good

During 1957, the strength of Spica increased during maturity, with high quality throughout. The extra growing period was beneficial to this variety for strength increases, which were not related to the protein contents. Festival, on the other hand, showed no improvement in strength or quality. The levels of both these assessments were below those of Spica, which could have been harvested at 50 per cent. moisture with excellent results. This, of course, would not be practical.

Spica followed a different pattern in 1958 from that of 1957. Here the strength was weak at the first harvest, but increasing strength was maintained to finish very strong at maturity. The quality of this variety followed a similar pattern to that of strength. Festival performed better in 1958 with increased strength and quality.

The results show that Spica performed better than Festival when grown in widely-varying seasonal conditions. Weather conditions had a marked effect on flour yields. Although two widely divergent weather conditions were experienced in 1957 and 1958, the results should be considered only for these two years.

Stock Foods

(*Continued from page* 545)

(*c*) The name of each of the materials of composition.

(*d*) The specific name and proportion or amount of any foreign ingredient.

Name and sole or principal place of business of the primary dealer or manufacturer, proprietor or distributor.

Mixtures of whole grains and/or seeds, and stock foods consisting of partly crushed grains and/or seeds, when the percentage of such that will pass a B.S. 14 sieve (1/21 inch) is less than 20 per cent. by weight of such stock food are not required to be registered or labelled.

In the case of prepared stock foods to which molasses has been added, the percentage of crude protein declared on the label should relate only to nitrogenous compounds derived from materials other than molasses.

nall Electric Cookers

With the growing variety of small electric ooking appliances on the market, plus excellent ublicity and sales activity, it is difficult to decide hich one to buy.

And while trying to make up one's mind hether to buy Black's or White's or Brown's r Green's article we sometimes overlook the ain question we should have asked first—Should we buy it anyway, irrespective of who ade it?"

For those who would like some help in finding e answer to these questions, Miss Nancy oskett, Senior Extension Officer, Women's ervice, New South Wales Department of Agriulture, suggests the following considerations:

The appliance needs of families differ, they re dependent on such things as family size, ealth, age, amount and type of entertaining one—and so only the family members can ecide which appliance will be most useful to hem.

One useful guide is to consider the types of oods and methods of cooking preferred by the amily, and buy the appliance which will meet he greatest number of preferences.

Will we use it often enough to get a fair eturn for our expenditure?

Appliances limited to a few tasks or used only several times a year could be big investments when compared with return in work done, time and energy saved.

One example of this could be the tea drinking family that buys a coffee grinder and a percolator; similarly the family that prefers instant coffee would have no use for a percolator.

Have we another appliance that does much the ame job?

Many appliances have more than one use, so tocktake the jobs those on hand can do before uying another—and if any new appliance can e multi-purpose so much the better.

Will it do the job beter than the method we ow use? For example, a stew will probably be s tasty no matter what appliance or utensil is used. On the other hand an electric kettle may e the only answer for a quick "cuppa."

Often time and energy are most important factors, but sometimes a family is prepared to sacrifice a little added time or energy for the sake of convenience and satisfaction.

Many appliances which are easy to use are discarded, or used infrequently, because their value and performance is judged after only one or two uses, instead of waiting until the user has become familiar with the new appliance.

This judgment should not be made until the appliance can be used with "familiar" confidence.

Many new, and old, owners of an appliance complain that "it doesn't do its job," "isn't what it was cracked up to be," and so on. In most cases these people haven't bothered to *read* the instruction book let alone follow the advice on use, care and special precautions—so ensure that all members of the family have read the book, and understand how to use the appliance.

A great deal of the value of small electric cooking appliances lies in being able to use them at the table, in the sunroom, on the terrace, so mobility of an appliance will be an advantage.

Electrical appliances depend on an adequate supply of power to give satisfaction. Many homes, particularly older ones, may not carry adequate wiring or enough power points for the number of electric appliances acquired by a family over recent years, and so top performance is not possible.

Is It Large Enough?

A frypan with a four to six serving capacity would have limited use for a larger family, and vice versa.

In addition, a growing family would be wiser to buy an appliance with a greater capacity than the needs of the present family.

Unless an article can be stored where it can be used readily or easily reached, it won't be used; and so will probably become a nuisance, a problem, and an extravagance.

Before buying make sure there is adequate and convenient storage, bearing in mind the basic rule for good storage—"store as close to where first used." This will make it desirable to store some small electric cooking appliances in the dining-room.

Which One Do We Buy?

The basic construction and performance of each type of a particular appliance, when made by recognised manufacturers, is much the same. The differences usually lie in the shape, the size and convenience features; and it is these features which frequently influence the final choice.

Today few articles are difficult to keep "looking like new," but check just the same.

It is wise to patronise a reliable manufacturer, and dealer, who will stand behind their merchandise.

When Buying Trays

Using a tray on everv possible occasion will save a homemaker both time and energy. Trays are not used enough, usually because there is something wrong with the tray or it isn't handy.

Convenient storage of trays will ensure they are used. They should be kept where they are most wanted, and must be easy to reach.

If the number of journeys is to be reduced it may be that trays should never be put away.

A tray should also be suitable for its intended purpose, and therefore, most households could do with at least two—a large one and a small one.

When buying trays the following questions should be asked—and answered.

- Is it strongly made and rigid in use? An all-rubber tray bends if over a certain size, while too thin a sheet of metal or laminated plastic sags when fully loaded.

The rim of the tray should give adequate support and rigidity.

- Does the rim or rod round the edge prevent cutlery and crockery falling off if the tray is accidentally tilted?

- Is it designed for easy cleaning? Rounded corners for example, are obviously more easily cleaned than sharp-angled ones, and dirt-traps must be avoided.

- Is it easy to pick up? The rim or handles should be raised sufficiently to allow the tray to be gripped before it is lifted from a table. A tray which has to be pushed to the table edge before the fingers can be placed under the handle is not a good buy.

- Is it comfortable to hold? There should be no sharp metal edges or other poorly finished surfaces, or badly recessed screws. The handles should be positioned to give a feeling of security even if the tray is not evenly loaded.

- How is the base of the tray finished? Rubber or felt pads on the underside avoid noise, protect both the surface on which the tray is rested and the tray itself, and prevent the tray bottom from becoming accidentally stained.

- Does the tray fulfil the purpose for which it is designed? A bed tray, for instance, must prove adequate in size for the serving of a simple three-course meal.

- Is the tray easy to store?

To Clean Fur Fabrics

Fashion trends have helped make fur fabrics popular. Women buying fur fabric coats, stoles, jackets or outerwear trimmed with lighter shades are reminded to carefully consider cleaning needs.

It is important to keep loose tags and labels relating to care and make of fur fabrics.

They should be filed for quick reference when e fabric needs cleaning.

When fur fabric coats are soiled, these are est cleaned by dry cleaners as it is difficult to ssess the washability of the paddings, inter- nings and linings.

Make sure you tell the dry cleaner the make nd label information of your fur fabric in case i is one of those which requires a special eaning process.

When fur fabric collars or cuffs of lighter nades become soiled before the whole garment eeds to be dry cleaned, they can be quite satis- actorily cleaned at home.

Similarly, darker trimmings on some makes of ar coats—which cannot be dry cleaned—can lso be cleaned at home.

Make up a solution of:

(1) One tablespoon of mild detergent to 3 pints of warm water, or

(2) a small handful of mild soap flakes completely dissolved in 1 gal. of warm water.

Using a soft brush, gently work a lather over the surface. Work on one area at a time, wiping each section after this treatment with a cloth wrung out of clean warm water.

Avoid getting the fur too wet or placing near a fire.

Hang the article to dry, preferably in the shade, and shake the fur fabric area occasionally if possible.

When the fabric is dry, use a stiff brush to give it a gentle rub against the pile of the fur. Finally, brush gently with the pile of the fur, and give it a good shake.

—N.S.W. Agriculture Department's "Press Notes."

R.N.A.-Shell Tour

Lunch Time at the Fairymead Feedlot. Fed a ration of sugar cane, lucerne, maizemeal, urea and molasses, these steers are gaining 2.65 lb. a day. They are ready for slaughter 100 days after being brought into the feedlot. The Fairymead feedlot, with a capacity of 600 steers, was inspected by members of the 1961 R.N.A.-Shell Journalists' Tour.

QUEENSLAND ACCREDITED PULLORUM TESTED FLOCK SCHEME

The following stock suppliers registered under *"The Poultry Industry Acts,* 1946 *to* 1959," have been admitted to the Queensland Accredited Pullorum Tested Flock Scheme on the basis of blood testing results in 1961. Flocks are graded into two classifications—(1) *Pullorum Free:* Where no reactors are found at the annual test in the year in which an application is made, as well as in the preceding year, *or* where no reactors are found at each of two consecutive tests carried out at an interval of not less than six months. A pullorum free flock shall be classified at such until positive reactors are found at the annual test. (2) *Pullorum Clean:* Where the number of positive reactors detected at the annual test does not exceed ·5 per centum.

Name	Address	Hatchery	Supplying hatching eggs	*Breeds tested for supply of fertile eggs or day-old chickens
Class 1. (*Pullorum Free*)—				
Badcock, W. S.	Finucane Road, Capalaba	+		A.O.W.L.N.H.M.
Basnett, A. M. and A. B.	31 Duncan Street, Wynnum West		+	A.O.W.L.
Bell, Miss D. J.	Boundary Road, Darra	+		A.O.W.L.
Bone, C. and N. V.	340 Rochedale Road, Rochedale	+		A.O.W.L.M.
Careclas, C.	North Street, Wilsonton, Toowoomba		+	A.O.W.L.N.H.
Carpenter, J. W.	Post Service 1880, Helidon		+	W.L.N.H.
Chapman, Mrs. E. M.	Ipswich Road, Oxley, Brisbane	+		A.O.W.L.L.S.R.I.R.
Conroy, V. P.	Biddeston, via Oakey		+	A.O.W.L.
Corbett, R. B.	P.O. Box 4, Woombye	+	+	A.O.W.L.
Dearling, V. R.	61 Holberton Street, Toowoomba	+	+	A.O.W.L.
Gamble, N. C.	Biddeston, via Oakey		+	A.O.W.L.N.H.
Harvey, J. T.	P.O. Box 288, Mackay	+		A.O.W.L.
Jorgensen, H.	Gympie Road, Aspley	+		A.O.W.L.
Kirkby, K. S.	772 Manly Road, Tingalpa	+		W.L.N.H.
Knopke, R. J.	Anderson Street, Cairns	+		A.O.W.L.N.H.
Lister, E. B.	Corio Hatchery, 25 Haig Street, Toowoomba	+		A.O.W.L.N.H.
Mengel, A. E.	181 Campbell Street, Toowoomba	+		N.H.
Mengel, C. J.	50 New Lindum Road, Wynnum West	+		A.O.
Seppanen, A. G.	Freeman Road, Richlands	+		A.O.W.L.
Shale, W. R. C.	503 Tingalpa Road, Hemmant	+	+	A.O.W.L.N.H.
Sherrie, G.	M.S. 1497, South Street, Toowoomba	+		A.O.
Skett, E. E.	Hoepper Street, Toowoomba		+	A.O.W.L.
Spicer, F. E.	66 Duncan Street, Wynnum West	+		A.O.W.L.
Stanfield, C. F.	2311 Logan Road, Eight Mile Plains	+		A.O.W.L.
Thompson, J. F.	Pacific Highway, Eight Mile Plains	+		A.O.W.L.
Weaver, G. A. C.	P.O. Box 240, Atherton	+		A.O.W.L.
Winwood, G.	Old Cleveland Road, Belmont	+		A.O.W.L.
Class 2. (*Pullorum Clean*)—				
Adams, C. R.	Gerrard Street, Middle Ridge, Toowoomba		+	N.H.
Baker, G. E.	Ferry Road, Moggill, Brisbane		+	A.O.W.L.R.I.R.
Bauer, J. S.	" Triangle " Stud Hatchery, Oakwood, Bundaberg	+		A.O.W.L.R.I.R.
Bowtell, C. W.	4 Payne Street, Toowoomba	+		A.O.W.L.
Bowtell, J.	North Street, Wilsonton, Toowoomba	+	+	A.O.W.L.
Brand, G. A.	Parkhurst, via Rockhampton	+		A.O.W.L.L.S.N.H.M
Downs Hatchery	4 Thorn Street, Toowoomba	+		A.O.W.L.N.H.
Elks, D. J.	Woodlands Poultry Farm, Beerwah, North Coast Line	+		A.O.W.L.
Gisler Brothers	492 Wynnum Road, Wynnum	+		A.O.W.L.M.
Gray, A. H.	768 New Cleveland Road, Gumdale	+		A.O.W.L.
Hargreaves, K. R.	Bedford Road, Andergrove, North Mackay	+		A.O.W.L.
Harper, A. W.	Arenga Street, Tingalpa, Brisbane	+		W.L.A.O.
Hills, F. E. and Sons	" Littlemore," Sims Road, Bundaberg	+		A.O.W.L.R.I.R.N.H.
Hoopert, A. E.	24 Greenwattle Street, Toowoomba	+		A.O.W.L.R.I.R.
Jamieson, J. A.	84 Randall Road, Wynnum West	+		A.O.W.L.
Langan, J. P.	120 Wynnum Road, Wynnum West	+		A.O.W.L.
Lax, G. E.	Pinklands, Cleveland	+		A.O.W.L.
Lindsay and Dobson	Morayfield, North Coast Line	+		A.O.W.L.
Lingard, S.	Sunridge Poultry Farm, Buderim	+		A.O.W.L.N.H.
Loveday, G. C.	" Attinga," Bruce Highway, Beerburrum	+		A.O.W.L.
Luke, N. E.	P.O. Box 141, Warwick	+	+	A.O.N.H.
Mann and Son	M.S. 195, Pittsworth		+	N.H.
Markwell and Miller	" Bingelima " Hatchery, Markwell Road, Caboolture	+		A.O.W.L.
Millman, H. H.	" Kingaroy Hatchery," P.O. Box 215, Kingaroy	+		A.O.W.L.R.I.R.N.H.
Moffat, A. K.	337 Mount Gravatt–Capalaba Road, Upper Mount Gravatt	+		A.O.W.L.
Moore, W.	1039 Broadwater Road, Mount Gravatt	+		A.O.W.L.
Moss, C. L.	Moss Road, Manly	+		A.O.W.L.N.H.
Obst, H. and Sons	" College Holme," Shepperd, via Toowoomba	+		A.O.W.L.
O'Sullivan, J. V.	Glen Road, Warwick		+	A.O.W.L.
Queensland Agricultural High School and College	Lawes		+	Various
Rub, A. J.	Nelson Street, Middleridge, Toowoomba		+	N.H.
Rumball, I and J.	Messines Ridge Road, Holland Park, Brisbane	+		A.O.W.L.
Schumann, C. and M.	Corner of Toohey and Monash Roads, Tarragindi	+		A.O.W.L.
Slaughter, R. E. and M. H.	Beams Road, Aspley	+	+	A.O.W.L.
Stehn, H. W.	283 West Street, Toowoomba	+		A.O.W.L.N.H.
Stehn, L. W.	Hodgson Vale, via Toowoomba		+	A.O.W.L.
Tesch, E. R.	Waterford		+	W.L.R.I.R.
Thorpe, H. G.	24 Augstein Street, Coopers Plains	+		W.L.R.I.R.A.O.
Vickers, R.	2130 Logan Road, Upper Mount Gravatt	+		A.O.W.L.
Warman, W. A.	D'Aguilar, Kilcoy Line		+	A.O.W.L.

* Breeds (abbreviations) :—

A.O. = Australorps ;
N.H. = New Hampshire ;
L.S. = Light Sussex ;
R.I.R. = Rhode Island Red ;
M. = " Meat type " breeds ;
W.L. = White Leghorn.

uide to Beef Grading

W. F. Snewin, Slaughtering Inspector.

It can be accepted that anyone purchasing ods wants to know something of their quality. is is equally as applicable to meat as it is to other class of goods.

A customer is interested primarily in the vour and tenderness of meat, but without some dance these qualities may be difficult to ermine.

Top quality in beef is a result of careful sbandry, involving intelligent use of know- ge, information, method, time and money.

The producer is dependent on the consumer rket, and so its requirements are important.

Grading is a guide to those requirements.

jects of Grading

The organisation of the Department of riculture and Stock makes it possible to plan adly, and to bring about developments that of benefit to the consumer, the producer and trade alike.

Slaughtering officers can, in the course of their ties, accurately gauge the requirements of both trade and the customer. These requirements be passed onto the husbandry branch, whose tension officers can relate the information back the producers in the field.

In this way the producers are encouraged to velop a better article, and the consumers are is better satisfied. A customer is usually epared to pay extra for satisfaction and this es an added incentive to the producer.

Grading, then, can be considered of great importance to all three—consumer, trade and producer alike. Thus the objects are threefold.

How It Works

The grading of beef carcasses involves a system of classification. The classes into which beef is graded differ one from the other. Within each specific class, however, a high degree of uniformity is desirable. In this way each grade name or brand mark comes to be recognised by the meat trade and by the consuming public as representing a particular type of beef.

The chief factors to be considered in the grading of a beef carcass are:

(1) Age

(2) Conformation

(3) Finish

(4) Quality

(1) *Age.*—There is no substitute for youth. The age of cattle may be judged by the permanent incisor teeth situated in the front lower jaw. Their eruption follows a regular pattern, though feed and breed may influence the teething events and rate of wear.

The temporary incisors or milk teeth are easily recognised by their small size and rounded form.

As age advances, the milk teeth are shed and replaced by the permanent incisors and the

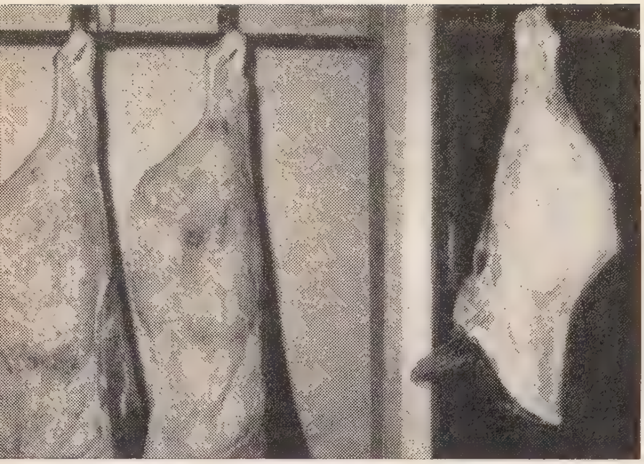
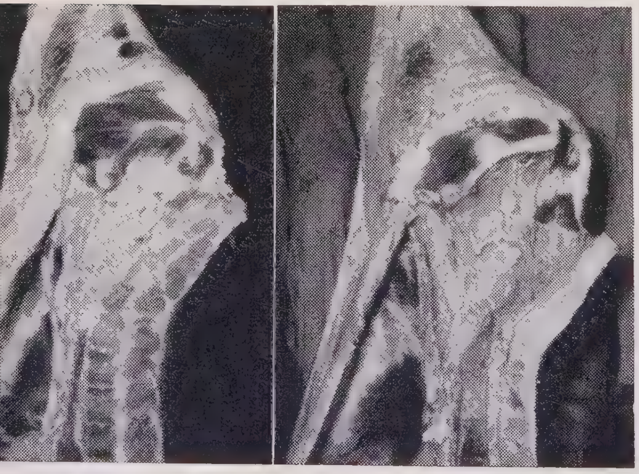


Plate 1

An Excellent Type of Hindquarter Is Shown On The Right. Conformation and finish make this type ideal for the local trade. On the left are two types of conformation seen in hindquarters—the long leggy type of a rangy beast on the left as against the short blocky type, typical of a good beef breed on the right. Breeders should aim for this latter type. Finish in both cases is quite suitable for local trade requirements.

Plate 2

Some Changes Associated with Ageing Are Readily Seen. Note the tubercle of the pelvis in the heifer (left) as compared with that in the aged cow (right). Compare also the shape of the H bone of the pelvis, the width of the pelvis cavity. The cartilage between and capping the bones of the sacrum is readily seen in the heifer, whereas the sacrum of the cow is one fused mass of bone with no cartilage evident at all.



following table will serve to indicate avera periods of eruption in the teeth of cattle:

First pair of incisors (Central) 1½ to years.

Second pair of incisors (Middle) 2 to 2 years.

Third pair of incisors (Lateral) 3 years.

Fourth pair of incisors (Corner) 3½ to years.

Later in life the teeth become worn and th gums recede, exposing the necks of the teeth.

However, age in carcass beef usually is dete mined by the condition of the bone. All catt after slaughter are split into sides, dividing th backbone and exposing the centre of the spin processes of the backbone so the bones may b observed. In young carcasses the divided bon of the thoracic vertebrae, that section of th backbone to which the ribs are attached, a porous and red in colour, with white cartila on their outer tips. These cartilages are small in size towards the last or floating ribs.

Behind these, in the middle of the back lumbar region, the vertebrae of the backbone a capped by narrow cartilages.

The change from cartilage to bone as a advances is gradual. The first signs are sm red bone cells appearing in the cartilagino extensions of the spinous processes of th vertebrae.

Between the tailbones and the lumbar centre backbones lies the sacrum, which consis of five bones. In very young animals, cartila is seen between these bones and they are capp with cartilage.

As age advances, the joints between th bones close, the cartilage becomes ossifi (replaced by bony tissue), and in matu carcasses these five joints are completely ossifie thus fusing the bones together and forming o solid bone.

The aitch bone, which is part of the pelv girdle, is covered by pearly cartilage over i whole length in yearling carcasses but in mo mature animals it is only partially covere Young animals have an oval-shaped knob at th lower end of the aitch bone, not present in th older females.

Plate 3

Showing Desirable Conformation Requirements. The carcass on the left has met the requirements of prime beef and has been branded as such. The carcass on the right is a yearling. All yearling carcasses at Cannon Hill are ribbon-branded with the letters "YLING." This yearling has a lesser degree of finish than the prime carcass, but this is quite acceptable for good quality in a youthful beast.

Plate 4

Depicting Differences in Forequarter Conformation and Finish. The forequarter on the right is ideal for local retail trade, while that on the left would be best suited for boning for canning or manufacturing.

Other indications of youth are found in the east bone of the brisket. The breast bone mprises seven bones which, in the younger imals, have soft white cartilage between them. s age advances, the bones fuse together leaving ly one permanent opening with little or no idence of pearly cartilage.

Further indications of youth may be noted on e ribs on the inside of the carcass. In the ung carcass the ribs are somewhat rounded in ape and show the red blood shading through e shell. This may be found also in the hind ank bone, which is the large bone of the lower g.

As age advances from yearling to 3-year-old, e red porous bone shows a gradual hardening om the inside towards the outer edge. The d shading recedes towards the cartilage on the os of the thoracic vertebrae. The carcass of a year-old animal will show the white cartilage at is point becoming spotted with red bone cells. ext to the cartilage is the red porous bone and en the greyish white bone. With age, the rtilage disappears, until finally the vertebrae pear hard, white and flinty. The breast bone is sed into a solid bone except for one permanent ening at the lower end and the sacral section fused into one bone.

Later still, the knob on the front end of the aitch bone becomes smaller and in old cows disappears completely. The ribs are wide, white, flinty and flat in old cows and the pelvic cavity is large.

Advanced maturity is also associated with a general decline in muscle thickness, increased roughness and irregularity in conformation and finish.

In females, the heifer udder is firm, rounded and practically solid fat. With active udder development, brownish mammary tissue appears. With succeeding calves, the cow udder becomes more loose and pendulous. Cow beef does not make the top grades.

(2) *Conformation.*—Conformation includes the general build, form, shape or outline of a carcass.

Its chief significance in grading is the close relationship existing between conformation and the relative percentage of each wholesale cut in the carcass as well as the proportion of edible meat to bone. The question of bone content is more important in beef than in mutton or pork. In mutton or pork, practically all of the bone is disposed of in the various joints, but with

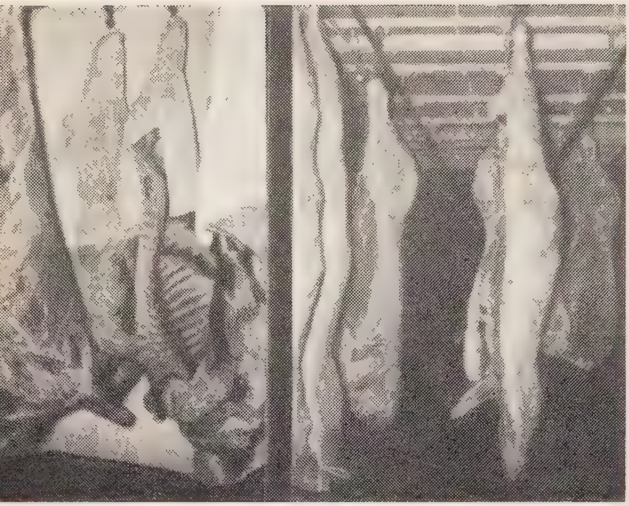
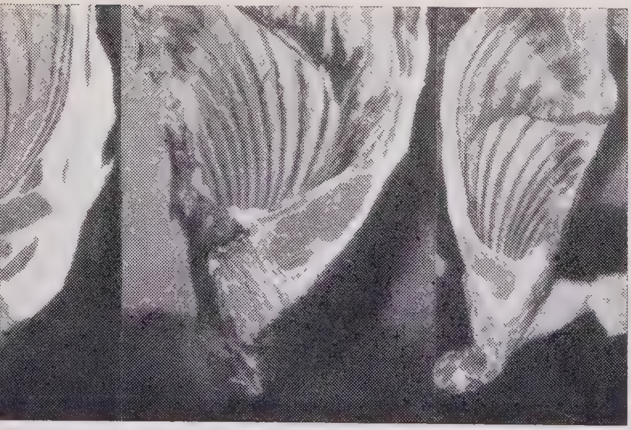


Plate 5

Two Extremes of Finish Are Depicted in These Sides. One side (left) is typical of a poorly finished cracker or boner type animal whereas the other (right) is extremely over finished. Note the bulging of the fat which has been laid on unevenly. (The eye-muscle cuts of these two carcasses are depicted in Plate 6.)

Plate 6

Various Stages of Finish Are Depicted in these Eye-muscle Cuts. The extreme of over-fatness is seen on the left while on the right is a poorly finished carcass, typical of the cracker or boner cow type. In the centre is a reasonably finished carcass, with the eye-muscle showing some degree of marbling. Note the proportion of lean to fat in the three carcasses.



beef a large percentage of the bone is removed before sale.

Steers and heifers differ in conformation.

Steers have heavier necks and shoulders, heavier bones and better hindquarters with better filled loins and rounds.

A desirable conformation is one in which the rounds are full fleshed on top as well as on the sides and edge-wise, viewing from the back of the split sides. The plumpness extends well down towards the hocks. The loins and ribs are thick and full; the chucks (the region of the first five ribs covered by the shoulder blade) are thick and the neck and shanks short. The carcass should be symmetrical and uniform in contour.

A poor conformation will show the rounds dished and falling in at the sides. The loin and rib through the back of the side will show a deficiency of fleshing below the edges of the lumbar and thoracic vertebrae. The chuck will show lack of fleshing.

Good breeding and good feeding join in the production of a well-proportioned, well-fleshed carcass of beef.

(3) *Finish.*—Finish refers specifically to the amount, colour, quality and distribution of fat.

A smooth, even coat of brittle, bright fat over most of the exterior of the carcass indicates a good finish. There are also liberal fat deposits between the large muscles and a generous distribution along the connective tissue and between the muscle fibres.

Good finish adds greatly to the appearance of a carcass but its chief advantage lies in the fact that it increases palatability. Juiciness and tenderness characterise meat with good finish. Well-finished animals have a higher percentage of rib and loin. The meat is superior, even in the less tender cuts, to that of an animal lacking finish.

While interior fat on the ribs is evidence of good feeding, lack of it does not necessarily debar a carcass from a top grade if outward characteristics are good. Moderate supplies of kidney and channel fat are desirable as indications of good finish. Occasionally, heavy deposits of fat in the region of the kidneys and channel are out of all proportion to the exterior fat

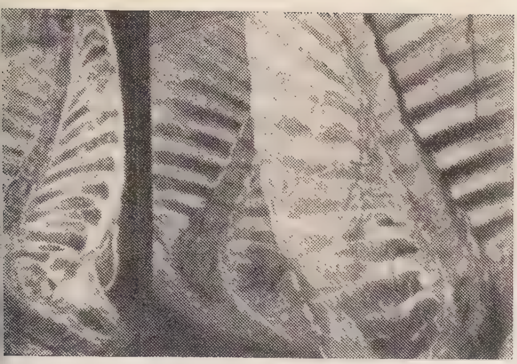


Plate 7

The Cartilaginous Extensions of the Dorsal Processes of the Thoracic Vertebrae Are Readily Seen in the Young Animal (left). The cartilage has completely disappeared in the old animal (right) which shows hard and flinty bone.

Plate 8

On the Left, an Inspector Marking a Prime Side at Cannon Hill Abattoir. The full side is shown on the right. Operators may voluntarily submit carcasses for prime branding, and those meeting certain qualifications for youthfulness, conformation and finish are ribbon branded with the letters "PRIME." Good breeding and good feeding join in the production of a well proportioned, well fleshed and finished carcass of beef.

covering. Invariably the carcass will be of a well-fed dairy type. Excessively fat carcasses are not good commercial propositions as they usually meet a limited demand.

Carcasses from animals that have been well bred and fed will show adequate finish and marbling before they reach the degree of heavy inside fat. Marbling is the intermingling of fat among muscle cells and between muscle fibres.

Surface fat is put on in the form of an S from the butt of the tail out over the hips and in over the ribs, following the ribs to the top back of the blade and down over the chuck. The last place for finish to show is over the outside of the rounds and along the shoulder top and neck.

The thickness of fat-covering desired for any grade depends on the amount of flesh the carcass carries.

Trade carcasses weighing 550 to 650 lb. and carrying ½ in. of fat at the rib cut have sufficient for choice beef, this being ample finish for the consumer who likes fat beef. As carcass beef weight decreases, the amount of fat covering desired is proportionately less.

The colour of fat ranges from white or light cream in young carcasses to yellow in the older carcasses. A yellow fat is seen in animals with more maturity.

A yellow fat in beef does not necessarily indicate poor eating quality but it is unattractive in appearance and in many instances this alone causes discrimination against it.

The yellow colour may come from the carotene in the grass or hay. It may be due to breed, as some dairy types have fat of a rich yellow and they pass it on to their offspring even when mated to types with light-coloured fat.

Should the yellow fat be due to the age of the animal, the meat will be tough and stringy. If it is because of inheritance from dairy breeds, the carcass will probably lack muscling and marbling and show poor conformation, lacking the full fleshing of the beef breeds.

Bruising plays a part in grading. If a bruise is superficial and easily trimmed, it is disregarded. Extensive or deep bruising will debar a carcass, side or quarter from the top grades.

(4) *Quality.*—The term "quality" here embraces characteristics of texture and firmness of muscle tissue, colour and marbling.

A soft watery meat is not a good quality meat. Texture and tenderness alone will not bring it into the top class. A soft greasy fat is indicative of low quality. The fat should be dry, hard and flaky.

The grain or texture of meat varies more with age than between animals of the same breed.

A fine texture gives meat a smooth velvety appearance. A coarse texture appears globular, this being caused by the thicker cell walls. As cell walls are the least tender part of the cell, the thicker the cell wall, the tougher the meat.

The colour of the meat is important in some respects. Beef ranges from bright cherry red in younger animals to dark red in older animals.

The colour of the lean may indicate how long a cut has been held. The cut surface of meat exposed to the air will cause it to lose moisture and to turn dark in two or three days.

Colour is not so important as an index of quality where carcasses of similar age and finish are concerned. Colour and texture of the bone are important as indicating age in the carcass.

In youth, bones are red and porous, show cartilaginous extensions in the spinous processes of the thoracic vertebrae and a smooth glossy pelvic bone.

In old age, bones are white, dense and flinty, show no cartilage on the end of the spinal processes, and have a hard pelvic bone and an ossified sacrum.

Marbling is an important factor in determining quality. The deposition of fat among the muscle cells and between the muscle fibres gives the appearance of a fine webbing of fat or streaks of fat, or both.

It is found in the flesh of highly finished animals that are approaching, or have reached, maturity. Its development is slower than the development of internal and external fat. Even in highly finished young animals there is little, if any, marbling. A high degree of marbling may be found in animals of 2 to 3 years.

Age and marbling must be considered together. Highly marbled meat may be derived from an aged, fat, beef-bred cow and in this case the meat will not be tender.

Marbling is important because the fa within the muscles or meat is high in aroma an flavour and is a good conductor of heat during cooking. It adds juiciness to the meat because it takes the place of water driven off by the hea of cooking. The melting fat retains the water soluble proteins which also are rich in flavou and aroma. After cooking, top quality steak will be tender, juicy and highly flavoured.

Unmarbled good grade steak subjected t similar cooking has not the protection afforde by fat. Water soluble proteins escape into th frying pan, moisture evaporates, the steak curls shrivels, and becomes dry, hard and relatively tasteless.

Types of Beef

Beef generally can be divided into the follow ing broad divisions:

(*a*) *Bull Beef.*—Bull beef is characterised b relatively heavy forequarters and massiv muscular development with usually poor covering of fat and little kidney and cod fat. In th forequarter the crest muscle is massive and th neck is thick. The colour of the flesh is dar and it has a coarse texture with a small total fa content.

This class of beef is used almost entirely fo sausage and prepared meats on account of it good binding properties, with usually a hig percentage of lean meat which when choppe up will absorb up to its own weight of water.

(*b*) *Cow beef.*—The majority of cow carcasse have a low degree of muscular developmen though the range can be wide, varying from young, one-calf, beef-bred cow carrying goo quality meat to the old cow whose muscles ar shrunken, the meat dry, with generally little fa covering and this frequently yellow in colour.

The cow carcass can be recognised by th udder, or, if this has been removed, a triangula patch is evident and easily recognised. Th pubic bone will be light and almost flat. Th pelvic cavity will be large and the flank thi The neck is long and thin and the crest muscl thin and narrow. While a proportion of co beef is sold in butcher shops, the majority o cow carcasses are boned out by wholesalers an anufactured into small goods. Often rumps nd loins are sold to the trade from the boning ooms.

(*c*) *Ox and heifer beef.*—This class of beef rms the bulk of beef consumed. The following atures are usually looked for in a good side of eef: a thick, full rump and loin, flesh extending ell down the leg, ribs nicely covered, and neck ort. The general build (conformation) of the arcass depends upon breed, environment, sex, ge and feed. Not only must the proportion of eat to bone be considered, but also the ratio etween the more valuable and less valuable ortions.

Some beef costs more to produce and will erefore cost the consumer more. Beef prouced from the slaughter of dairy types—steers r culled heifers and cows—though less attracve, is cheaper, and quite as nourishing as that om beef breeds.

Though the meat from dairy bred cattle is rotein-rich and contains the desirable amino cids present in meat generally, it has not the ttractive appearance, the even distribution of it and the fullness and development of the beef reeds. There is also a lower percentage of eat to bone and a greater ratio between the aluable and less valuable cuts of meat. The airy carcass produces a type of meat which lacks e full-fleshing, finish and flavour of the beef reeds.

In the final analysis, the customer determines hat is required in beef. Climate plays its part this. In subtropical and tropical Queensland, the leaner carcasses are in demand. In colder climates fat assumes a more important role in the human economy.

All Beef Is Good

All beef is good beef and is equally as nourishing, pound for pound, when used as human food. However, if nourishment were the only criterion then grading would not be so valuable.

It is the grader's duty to provide a reliable guide for customers' preference or requirements.

Prime, young, tender, flavoursome meat is marked according to its actual or probable condition. Lack of reasonable pre-slaughter care can adversely affect the tenderness and quality of what should be a prime, tender cut of meat.

It will be appreciated that when a carcass is broken up into the primal cuts—rumps, loins, topsides, silversides—it readily loses its identity. In the absence of grade marks, the selection of requirements by the customer may be difficult. Just as the proof of the pudding is in the eating, so is the grade of the beef evident on the plate.

There is a world of difference between the juicy, succulent, tender piece of steak and the tough, shrivelled, relatively tasteless piece.

When the grader marks the carcass from which top quality meat may be taken, it is readily distinguishable from the lower grade of carcass.

The customer who prefers high quality meat is, through the medium of grading, afforded the opportunity to select his requirements.

Soybeans at Warwick

Soybean variety trials at Hermitage Regional xperiment Station last year indicated the possiility of obtaining successful yields of this crop the Warwick district. Nine varieties were tested t Hermitage in the 1960-61 summer. Three lantings were made, from early to late November, 960, the object of the work being to investigate e performance of varieties with relation to time f planting. Due to the different responses of arly and late varieties of soybeans to seasonal ctors, it is important to relate varietal performnce to planting date.

It was found that early and late flowering arieties of soybeans, at Hermitage, varied by up 14 days from time of germination to time of appearance of the first flowers. Later planting resulted in a shortening of the time from germination to flowering. However, under the long day conditions of middle to late summer, the seed of all varieties ripened at approximately the same time for all plantings, so that it was possible to harvest all plantings on the same date, the eighth of May.

An average yield of 860 lb. of seed was obtained per acre for the nine varieties tested. Earlier flowering varieties gave higher yields and the top variety, which was also the earliest flowering, yielded slightly in excess of 1,000 lb. per acre.

—R. L. HARTY, Officer-in-Charge,
Hermitage Regional Experiment Station.

TOP: Trevor Perrett, 19, of Messrs. J. R. Perrett and Sons' Mt. Hope Poll Hereford Stud, Kingaroy, was hard at it grooming up-and-coming sire, Wahroonga Gangster, 18 months, when the 1961 R.N.A.-Shell Journalist tourists arrived. Mt. Hope Stud, established in 1934, is one of the oldest Poll Hereford Studs in Queensland. Mr. Perrett has been a successful exhibitor at the Brisbane Royal Show for 25 years.

BOTTOM: Mrs. Lance Hooton, of Tabulam, N.S.W. (formerly Miss Oriel Pickels, of "Saldanha", Coolabunia) puts champion hack Supreme through his paces for members of the R.N.A.-Shell Journalists' tour. Supreme has an impressive list of Brisbane Show successes, including a championship in the 10 st. class in 1956. Mrs. Hooton's father, Mr. J. R. Pickels, is a well-known exhibitor of hacks at the R.N.A. Exhibition.

rrigated Pasture Mixture For Central Queensland

y **B. GROF, Agrostologist.**

Since 1955, investigation of irrigated pastures s been carried out at the Regional Experiment ation, Biloela. Main interest has been con-ntrated on the selection of suitable pasture mix-res, their establishment, productive capacity, d management techniques for local conditions.

The Station is located some 50 miles south of Tropic of Capricorn; the annual rainfall is proximately 28 in. (mainly of summer idence) and the evaporation amounts to 75 in. year. During the autumn-spring period the owth of both native and introduced summer owing pasture species is limited by low rainfall d temperatures.

On the alluvial soils, irrigation, which is avail-le from both underground and surface supplies, s extended the use of temperate pasture ecies into this area, which is beyond their recognised region of adaptation. Under these conditions the growth of clover is not inhibited and consequently pastures of high production and quality can be maintained with suitable mixtures.

The Clover Component

Recent studies into the rate of growth and yield of Ladino clover indicate that high production can be obtained under a fairly wide range of temperature conditions. High temperatures do not limit Ladino clover growth, provided moisture is in adequate supply.

The cumulative yields and weekly growth increments of Ladino clover in a mixed sward, over 5 weekly periods in August-September and again in January-February are shown in Table 1. Temperatures during these weeks are included for comparative purposes.

TABLE 1

LADINO CLOVER YIELDS

LB. PER ACRE OF DRY MATTER (OVEN-DRIED AT 80° C.)

/eeks rowth	August–September				January–February			
	Clover	Weekly Increment	Weekly Average Temperature deg. F.		Clover	Weekly Increment	Weekly Average Temperature deg. F.	
			Maximum	Minimum			Maximum	Minimum
1	447·7	..	74·6	33·6	272·2	..	90·3	64·2
2	760·7	319·0	76·3	46·4	730·7	458·5	91·5	66·6
3	1,091·7	325·0	77·8	43·9	1,143·7	413·0	95·0	68·8
4	1,354·3	262·6	77·9	50·2	1,277·0	133·3	93·5	68·0
5	1,545·5	191·2	78·0	49·5	1,419·3	142·3	84·0	67·0

Plate 1

An Irrigated Pasture of Perennial Prairie Grass and Ladino Clover Gives Good Production Except in Mid-Summer.

Plate 2

A Pasture of Phalaris arundinacea and Ladino Clover is Highly Productive Except in the Winter Months.

Soil moisture in each case was maintained at the optimum level, supplementary irrigation being applied at weekly intervals during rainless periods in the summer.

Ladino clover was developed under irrigation conditions in northern Italy and is widely used in the U.S.A. It is readily distinguishable fro the small-leaved short type of "wild" white clover and from the intermediate growth forms, b reason of the fact that all parts, including stolon leaves, petioles, but with the exception of th seed, are larger than the corresponding parts o other clovers.

Ladino clover is outstanding because of it higher all-the-year-round production and hea tolerance. It is more compatible with vigorou grasses than the irrigation white variety. Further more, it shows persistency and a free-seedin habit, both of which characteristics are importan in a permanent pasture ley. It possesses a robus aggressive habit and establishes rapidly. For thi reason it is likely to smother other species whic are either slow to establish or have a long perio of dormancy in this subtropical climate.

A Ladino clover-reed canary grass (*Phalari arundinacea*) pasture in the fourth year afte establishment produced 10·36 tons per acre o air-dried forage whereas an irrigation white clove reed canary grass pasture yielded 5·35 tons pe acre in the same year. Both pastures were stabl in composition at the time.

The Grass Component

The species of grasses tested included tho commonly used in temperate climates in th southern States of the Commonwealth.

Several of these showed slow establishment a initial growth, as well as poor persistence. I most cases the short period of seasonal grow was a decided disadvantage.

Pasture management and soil fertility a mainly responsible for the persistence of grass a sward. Temperature is a limiting factor whic affects the duration of growth of the so-calle "English" grasses, for example, rye grass an cocksfoot. Work carried out in New Zealan indicates that optimum temperatures for th growth of these grasses are those between 65 an 70 deg. F., and that a rapid decline in grow rate occurs when the temperature reaches abo 85 or below 55 deg. F.

On the other hand, Ladino clover havin slightly higher heat tolerance maintains vigoro growth throughout the year under central Queen land conditions. Because of this, competitio from clover is always present and is responsib a large extent for the disappearance of those asses which have a short, restricted season of owth.

The experience obtained with the various grass ecies may be summarized as follows:

aspalum (*Paspalum dilatatum*)

Paspalum is a summer growing grass producing eavily during the warm months but it is dormant winter.

Growth is rapid from December to March, and ard grazing and careful management are neces-ary to prevent the grass becoming tall and rank, nd from running to seed.

Once paspalum has flowered, its leaf produc-on is slow; the rank growth is neglected by stock. aspalum pastures can become sod-bound to the xclusion of white clover that may be in the ward.

Failure to keep paspalum under control in ummer usually results in smothering of the clover egrowth in the following winter.

It is good practice to slash rank paspalum pas-re ahead of grazing. A rotary slasher is very itable for this operation. "Topping" will result a greater production of young palatable grass nd will ensure that the clover develops satisfac-rily in the winter and spring months.

To obtain a good balance of clover and grass, d-bound paspalum-dominant pastures will have be renovated. This is best done with the ffset disc-harrows followed by the broadcasting f Ladino clover over the sward. The tall, aggres-ive Ladino clover is more compatible with aspalum than is the irrigation white clover ariety.

I1 (Hybrid No. 1) Rye Grass

H1 rye grass (short rotation rye grass) is a ariety developed by the Grasslands Division of lew Zealand, by hybridization between Italian nd perennial rye grass with subsequent progeny election. The aim was to obtain a hybrid with aximum development of the desirable features f Italian rye grass and to introduce to some legree the density and persistence of the perennial ariety. Italian rye grass is an annual species nd is noted for its rapid establishment and high roduction during cool weather.

The effect of environmental conditions on the persistence of H1 rye grass is well indicated by a recent survey in New Zealand. In the Dunedin and Southland districts, short-rotation rye grass was classified as permanent, whereas on about 42 per cent. of the farms in North Auckland, H1 rye grass lasted less than 2 years.

In central Queensland, H1 rye grass behaves as an annual, providing a large bulk of feed in winter and spring.

Annual resowing, either by a sod-seeder or by the conventional drill, can provide a balanced pasture for a period in the year of establishment. The annual habit of H1 rye grass renders it more suitable for short-term pastures than for permanent pastures.

Toowoomba Canary Grass (*Phalaris tuberosa*)

Phalaris tuberosa is a perennial species of great value and importance in the winter rainfall areas of Australia. It is also used widely in irrigated pasture mixtures. Phalaris also makes the bulk of its growth during the cool weather. It makes a slow start and it can be crowded out by vigorous species in the year of establishment.

This grass has been included in simple, one-grass-one-clover mixtures as well as in complex clover-grass and lucerne-phalaris mixtures.

Although it was successfully established and good production was obtained for two seasons, it has gradually disappeared from the sward and at the end of the fourth season no trace of it could be seen.

Cocksfoot (*Dactylis glomerata*)

Under irrigated conditions in southern Australia, cocksfoot behaves as a summer species.

In central Queensland, it has a limited period of seasonal growth. It is affected by both high and low temperatures, making its best growth during the spring. For the remainder of the year it remains practically dormant. These factors, together with its slow rate of establishment, were responsible for the loss of this grass from clover swards.

Prairie Grass (*Bromus catharticus*)

The commercial strain of this species, Priebe's perennial prairie, has excelled for autumn, winter and spring production. The advantages of this particular prairie grass, apart from its vigorous growth during the cool weather, are its free-seeding habit and its ready establishment from self-sown seed. Furthermore, during the summer only moderate dormancy was noted.

Its persistency under local conditions is not quite clear. However, the free-seeding and self-regenerating habit make it almost as useful as a true perennial species. Heavy seeding takes place during the early summer months of October to December and seedlings emerge as early as January and continue to emerge through the cool weather. The wide range of conditions suitable for germination simplifies maintenance of this species in the sward.

A few weeks spelling from grazing during the early summer will allow the seed to mature and shed.

It is best to avoid grazing when seedlings appear in large numbers, the removal of the excessive clover growth being better achieved by high-topping with a mower or a rotary slasher. As an alternative, light cultivation with a disc-harrow will assist the germination of prairie grass and it will also suppress the clover until the grass becomes properly established. A convenient time for this operation is in the autumn.

Reed Canary Grass (*Phalaris arundinacea*)

This species of Phalaris makes most of its growth during the summer, but is productive until killing frosts are experienced. It is dormant in the July-August period. Regrowth commences in mid-September and it contributes actively to the sward from October onwards

This grass showed the greatest persistence in various mixtures, the stand increasing as soil fertility improved under the clover ley.

The seeding rate varied from 1½ lb. per acre in complex mixtures to 4 lb. per acre for a simple mixture. These seeding rates are satisfactory if one is prepared to wait for one or two years while the stand increases. The germination of the seed is often unpredictable and it is recommended that higher seeding rates be used. If 6 lb. of *Phalaris arundinacea* seed is sown per acre good stand should be obtained in the year o establishment, and the higher returns in the firs year will more than offset the additional cost fo seed.

Seed Mixtures for Irrigation Pastures

In all sowings at the Biloela Regional Experiment Station, the complex mixtures, originally containing such species as white and strawberry clovers, H1 rye grass, cocksfoot and the two phalaris species, reverted to a simple mixture which consisted of white clover and reed canary grass. The complex mixtures produced heavily for 1 or 2 years, but under regular grazing the less compatible species were crowded out.

The reduction of species makes for easy management.

At this stage two simple mixtures which have shown distinct promise can be recommended fo permanent irrigated pastures, in central Queensland.

(*a*) Phalaris arundinacea–Ladino clover. This mixture is mainly suitable for spring-late autumn grazing.

(*b*) Priebe's perennial prairie–Ladino clover. This is essentially for autumn-winter-spring grazing. Both grass species are compatible with Ladino clover.

If these two mixtures are sown in separat fields, and flexible management according to the requirements of the component species is practised, they can supply a balanced pasture of high quality for the whole year.

Seeding Rates

The recommended seeding rates for these two mixtures are as follows:

(*a*)	Ladino clover	2 lb./ac.
	Phalaris arundinacea . .	6 lb./ac.
(*b*)	Ladino clover	2 lb./ac.
	Priebe's perennial prairie . .	8 lb./ac.

Establishment—Management

Sowing is best carried out during the cool part of the season.

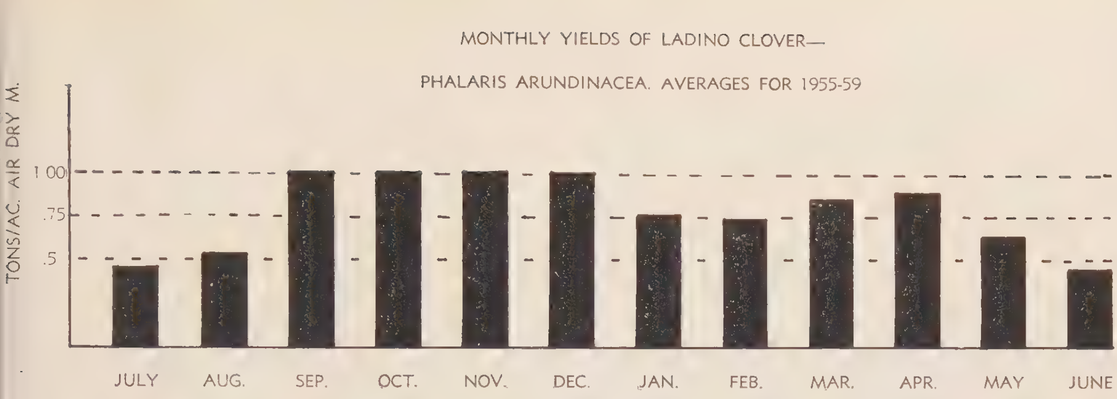


Plate 3

Average Monthly Yields of an Irrigated Pasture of Phalaris Arundinacea and Ladino Clover at the Biloela Regional Experiment Station.

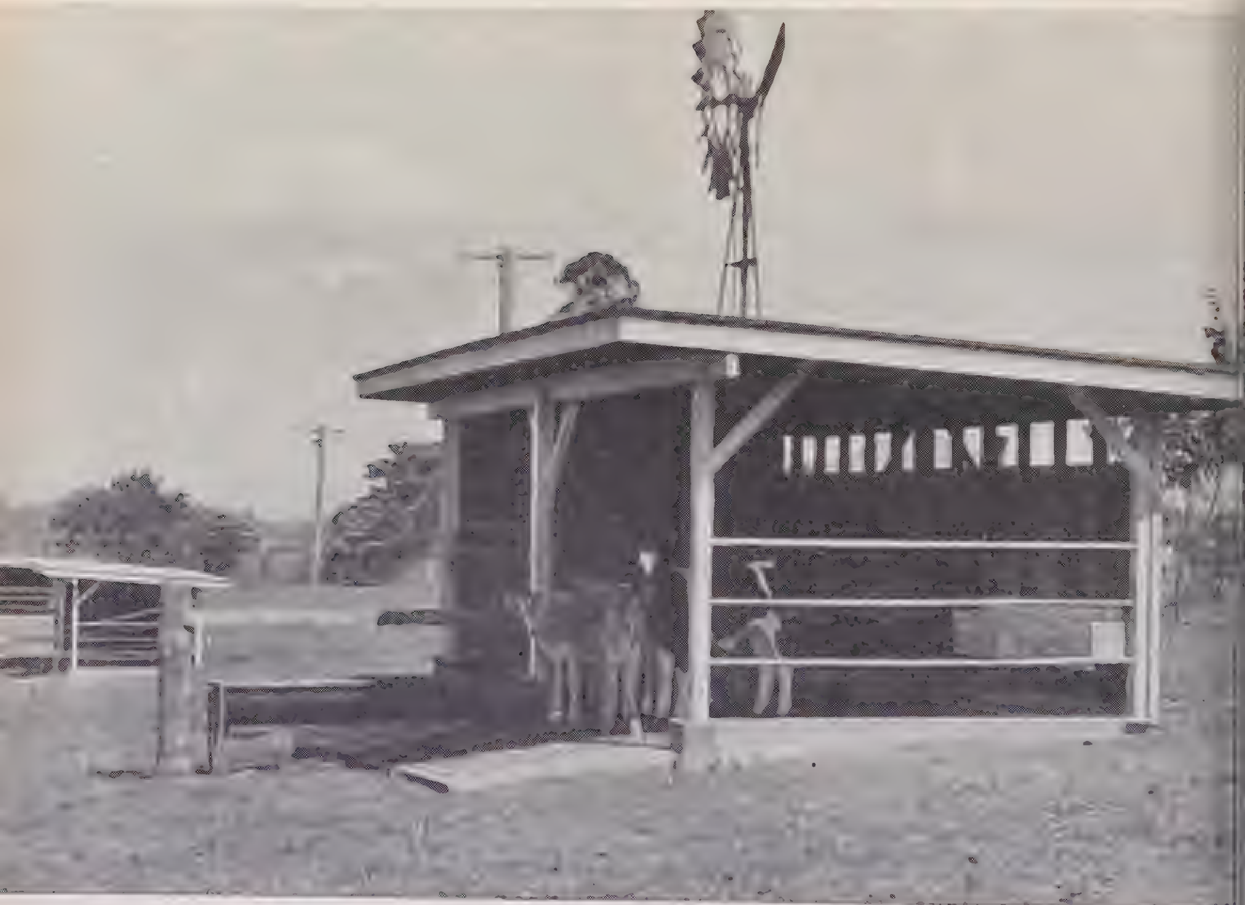
Vith regard to the phalaris arundinacea–dino clover mixture, it should be noted that grass is a summer grower, and that growth, ticularly of the seedlings, is very slow during iods of frost. This mixture should not be sown er than 6 weeks before the first frosts can be ected.

Grazing schedules should be adjusted so that during the growing period of the grass, the Ladino clover–phalaris mixture in a vigorous state, may be grazed for one week in every five.

A similar grazing interval is recommended for the other mixture, but an adequate spell from grazing should be allowed during October-November so that the grass may set its seed.

Irrigated pasture is permitting a stocking rate of a beast to three acres on Mr. J. Stewart-Moore's "Charraboon" Droughtmaster Stud at Toogoolawah. He has 75 acres of irrigated lucerne, and Louisiana white clover and Priebe's perennial prairie mixed pasture. To save the pasture from excessive trampling under heavy grazing, it is cut with a forage harvester and fed out in another paddock. It was feeding time for some of the Droughtmaster breeders and their calves when the 1961 R.N.A.-Shell Journalists' tour arrived.

Kairi Shelter for Calves



R. T. STRACHAN, Adviser in Cattle Husbandry.

Calf rearing is a problem in the major dairying
as of our State—due largely to our tropical
d subtropical environment. Periods of excess-
wet, and months of hot, humid weather are
uncommon. Therefore, if we want the best
ults from well-planned breeding and feeding
is very important to protect our calves by
viding suitable shelters.

The true value of the calf shelter shed has
en demonstrated at the Regional Experiment
tion at Kairi on the Atherton Tableland. At
s Station where up to 30 calves are reared
ery year, three shelters have been constructed.
ch shelter has been placed to provide adequate
otection to the calves while they graze six
ddocks under a rotational system. The fact
t the calves have made continuous use of the
elters has demonstrated their value. Records
the Station also reveal that better grown and
althier calves are now being reared at less
st. The calf shelters have:

(*a*) Given protection from the sun at a stage when the calf is most susceptible to heat stress.

(*b*) Given protection from the hazards of wet weather.

(*c*) Resulted in a saving of food costs. This has been the result of protecting grain fed to calves from the weather and from being contaminated by the calves.

(*d*) Avoided excessive pasture spoilage which in turn has resulted in better and healthier pasture being available to the calves.

(*e*) Enabled the rearing of healthier calves by ensuring better control over major sources of infection, including contaminated pasture and grain.

Suit Any Area

Designed for that particular area, the type of shelter in use at Kairi Regional Experiment Station has proved to be a very practical and effective unit. This design could be readily adapted to suit any area of Queensland. A variety of materials could be used in its construction.

The Kairi shelter illustrated has been built to serve two paddocks. The iron gate, which is 8 ft. wide, can be locked in any of three positions, permitting full use of the shelter should either paddock or both be in use at the one time. The shelter is 16 ft. long and 8 ft. wide, with the iron roof sloping from 7 ft. in the front to 6 ft. at the back. The two walls on the eastern and southern sides give adequate protection from the rain and prevailing winds. The open sides allow for ample ventilation plus the admittance of the sun for part of the day, sufficient to ensure drying out of the floor. Further ventilation is provided by an air space 1 ft. wide in the rear of the shelter. The floor is of concrete to permit more effective cleaning, disinfecting and drying. Two wooden troughs attached to the rear walls a distance of 2 ft. from the floor are used for grain and mineral supplements.

The cost of materials used in this shelter was: Timber, £31 10s.; iron, £17, concrete floor, £12 10s., extra items, £4, giving a reasonable total of £65. A capital outlay of, say £80, (including labour) on a shelter lasting 20 years would incur annual charges of less than £9 with interest at 6 per cent., and depreciation at 5 per cent.

On a basis of the rearing of 10 calves a year, the housing and grain feeding facilities would cost under £1 a calf. With feed costs in the region of £7 to £10 a calf, this cost for housing could be regarded as reasonable in view of the benefits obtained.

It is very desirable that the shelter be kept clean. This is achieved by the removal of all accumulated manure from the floor after each week that the shelter has been in use. In practice, a shelter at Kairi is in use for only 2 in every 6 weeks.

Bedding is not regarded as a necessity in this area.

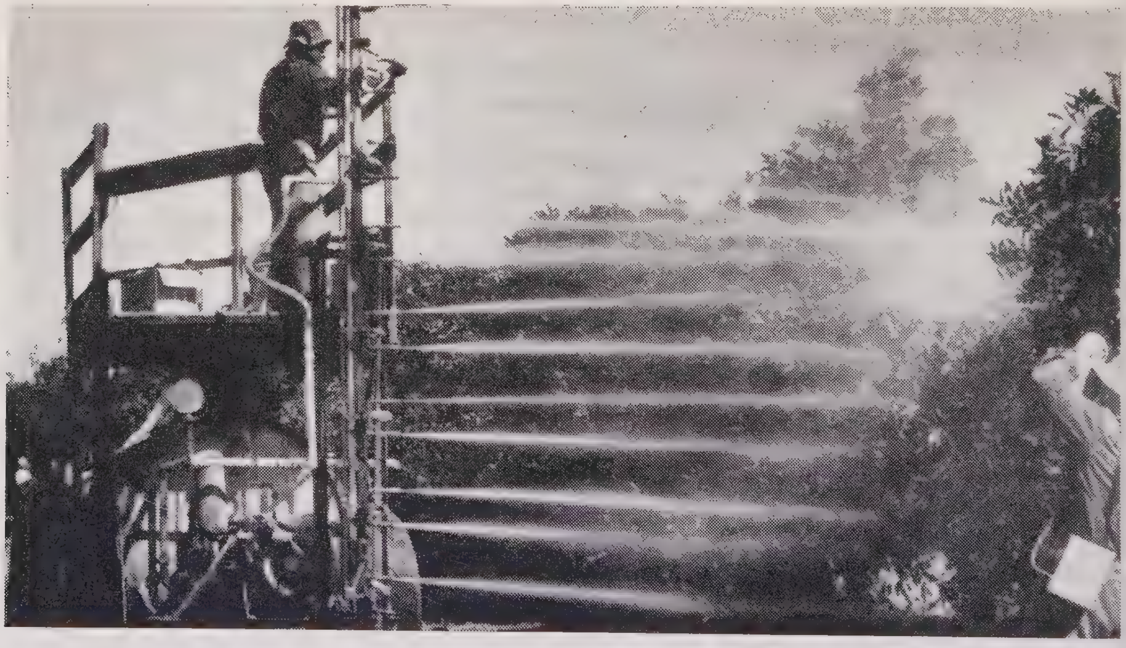
The Essentials

The type of shelter for your farm will depe on the herd size, the amount of rainfall a prevailing winds common in your district, a last but not least, finance.

A very useful shelter could be built out different materials including second class timb and iron. The painting or oiling of the timb in the construction would be desirable as t would lengthen its life as well as improve appearance and value. When planning a shel for your calves, whatever the design, that shel must have:

(1) A substantial floor, preferably concrete
(2) Adequate protection from sun, wind a rain.
(3) Satisfactory ventilation.

The rearing of good herd replacements c be a costly business on the dairy farm if loss occur. These costs must be kept to a minimu by sound husbandry methods. By providing su able shelter for your calves, pre-weaning deat will be kept at a minimum and better weane will be your reward.



The need to spray 8,000 citrus trees several times a year calls for something faster than a knapsack spray. Mr. Tom Benham, of "Benyenda" Orchard, Byrnestown, near Gayndah, has found the answer to his problem in this mechanical spraying machine. Moving at walking pace, it delivers 40 gal. a min., drenching each tree from crown to ground. Spraying was in progress at "Benyenda" when members of the 1961 R.N.A.-Shell Journalists' tour called.

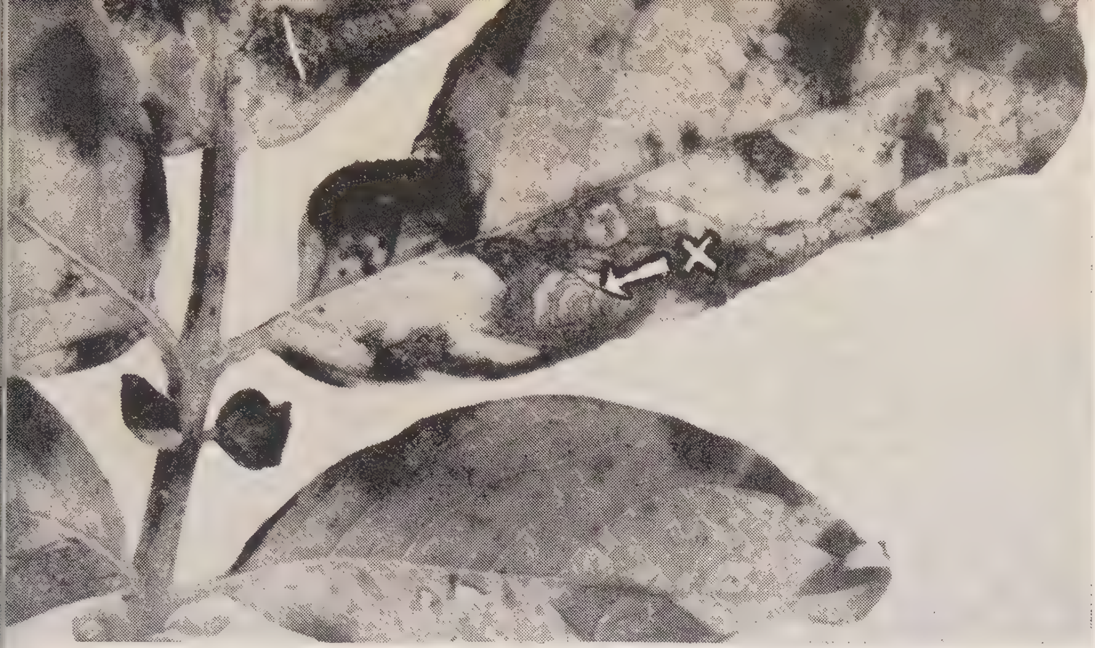


Plate 1: **Target Spot.** Note zonate appearance of spot (marked x).

otato Diseases In South-East Queensland

By I. K. HUGHES, Pathologist.

This article deals with potato diseases in south-east Queensland and the control measures ilable for these diseases.

ost of the south Queensland potato crops are n with irrigation, and as the area of irrigable suitable for potato culture is limited on most s, potato land is very intensively cultivated. important, therefore, that potato growers me conversant with potato diseases, particularly those which, when introduced to an area, persist in the soil and render the area unprofitable for potato culture for many years.

The following table gives a key to the identification of potato diseases, the important diseases being given in capitals:

TABLE 1

KEY TO POTATO DISEASES

Diseases of the Plant.	
A. Plants wilted.	
1. Stem or root rotted.	
a. Internal stem discoloration present	
(1) Bacterial ooze on cut surface of stem or root	BACTERIAL WILT
(2) No bacterial ooze on cut surface of stem or root	FUSARIUM WILT
b. Internal stem discoloration absent.	
(1) Bacterial ooze on cut surface of stem or root.	
(*a*) Extensive black rot of stem	Black leg
(*b*) No extensive black rot of stem	BACTERIAL WILT

TABLE 1—*continued*

KEY TO POTATO DISEASES—*continued*

(2) No bacterial ooze on cut surface of stem or root.	
(*a*) Rotting near or below ground level.	
x. Constriction at point of injury. No fungus obvious	Rhizoctonia rot
y. White fungus present with hard radish-seed-like bodies	Sclerotium rolfsii
z. Black shoe lace strands of fungus present	Armillaria mellea
(*b*) Rotting of aerial parts.	
x. Delicate white down of fungus present	Irish blight
2. Stem and root healthy.	
a. Plants yellow, young growth often with purple colour. Aerial tubers often present	PURPLE TOP WI
B. Plants not wilted.	
1. Plants stunted.	
a. Ring spots present on young tissue	Spotted wilt
b. Young leaves puckered, veins dark, old leaves dead	Rugose mosaic
2. Plants not stunted.	
a. Dead areas present on leaves.	
(1) Young leaves affected, ring spots present	Spotted wilt
(2) Old leaves affected, spots target-like	TARGET SPOT
(3) Old leaves affected, white fungal down present	Irish blight
b. No dead areas on leaves.	
(1) Leaves with indistinct interveinal mottle	Mosaic virus
(2) Leaves uprolled, texture harsh	LEAF ROLL VIRU
(3) Stems with white powdery fungus	Powdery mildew
II. DISEASES OF THE TUBER.	
A. External symptoms present.	
1. Tubers sound.	
a. Scab-like depressions on surface	SCAB
b. Raised black fungal bodies on surface	Rhizoctonia scab
c. Raised white corky growths on surface	Enlarged lenticels
d. Sprouts weak and spindly	Spindle sprout
2. Tubers rotted.	
a. Dry rot.	
(1) White fluffy blobs of fungus present	FUSARIUM DRY
(2) Thumb mark depressions with minute black bodies on surface	Phoma rot
b. Wet rot.	
(1) Rotted flesh darkly discoloured	Irish blight
(2) Eyes showing bacterial exudate	Bacterial soft rot
B. No external symptoms present.	
1. Flesh discoloured.	
a. Brown flecks in flesh	Brown fleck
b. Tuber black in middle	Black heart
c. Brown network in water-conducting tissues	LEAF ROLL
d. Translucent colour of flesh towards the stem end	Glassy end
2. Flesh normal colour.	
a. Hollow in centre	Hollow heart
b. Tubers soft in texture	Soft tubers

SYMPTOMS, CAUSES, CONTROLS

outline of the symptoms, causes and con-
of these diseases follows:

Target Spot (Early Blight)

rget spot is the most important leaf-destroy-
isease of potatoes in south Queensland. It
be commonly encountered in the warmer
ner. The popular varieties in order of
asing susceptibility are Sequoia, Exton,
go and Kennebec.

TOMS

e disease appears first as small black dead
on the leaves (Plate 1). These spots extend
ually to large lesions (half an inch in
eter) which display a zonate appearance.
concentric pattern of the spot frequently
nbles a target—hence the name of the dis-
Older plant parts are usually more severely
ted. Individual spots may coalesce to give
plete defoliation. Lesions on the stalk may
r and cause a collapse of the portion above.
disease does not extend to the below-ground
of the plant but may affect the tubers after
ng.

SE

rget spot is caused by a fungus* which pro-
s dark-coloured spores on the surface of the
. These spores are difficult to see with the
d eye. They blow freely in the wind and
conditions are favourable they may germin-
and penetrate the leaf tissues to create new
tions. Once infection has occurred within a
, considerable leaf loss may be expected
in a few weeks.

TROL

here target spot appears early in the life of
op, control measures are warranted. Spray-
or dusting with fungicides has been widely
oted to control this disease. In experimental
, zineb spray, zineb dust and maneb each
good control. Fortnightly spraying or dust-
reduced leaf loss from 80 per cent. in the
eated to approximately 30 per cent. in the
ed. Current recommendations are to spray
dust at fortnightly intervals with zineb or
eb preparations. Spraying should commence
e first sign of target spot in a crop.

Attention should be paid to spray coverage. There is little point in increasing spray concentrations and reducing spray volume if incomplete coverage results. The aim is to have distribution of the fungicide over both surfaces of the leaf. Insufficient spray coverage is the principal cause of failure to control target spot in the field.

Irish Blight (Late Blight)

Irish Blight (Plate 2) has, in previous years, demonstrated its ability to cause disastrous crop losses under weather conditions which favour its development. Prior to 1956, infection occurred on Exton, Monak, Adina, Walanga, Sebago, Sequoia and Factor varieties. However, no epidemics of Irish blight have been recorded since 1956. The discontinuance of some of the highly susceptible varieties and the widespread use of fungicides for the control of early blight (target spot) may be responsible for the absence of this disease in recent years.

SYMPTOMS

Early infection is noted by the presence of soft black areas on the leaves, which may spread to involve the whole of the foliage, the leaf stalks and, finally, the stems. A severe infection leads to the complete death of the above-ground parts with subsequent tuber infection, either from the disease spreading down the underground stems or by direct infection of the exposed tubers before or after digging. The tuber symptoms consist of a sunken skin beneath which are areas of brown tissue extending to various depths into the potato. Under moist storage conditions, the tubers may rot away completely.

CAUSE

Irish blight is caused by a fungus† which in cool moist weather produces spores on the surface of the black lesions just described. Fruiting structures and spores of the fungus can be seen with the unaided eye as a delicate white down. The spores are spread by wind and rain to other portions of the plant, to produce new infections if conditions are favourable for the development of the fungus.

Moisture is necessary for the development and spread of Irish blight, but, in addition, temperature is an important factor in its incidence, for it is one of the diseases which is favoured by cool weather.

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lternaria solani.

† *Phytophthora infestans.*

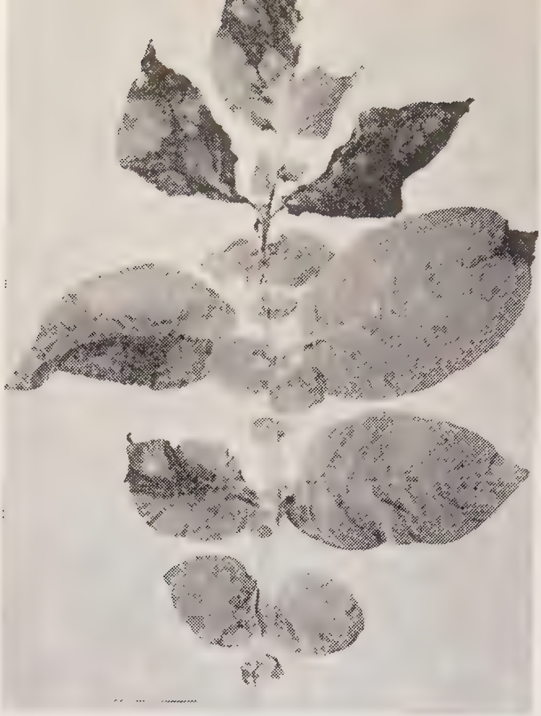


Plate 2: **Irish Blight** Causing Damage to Potato Leaf.

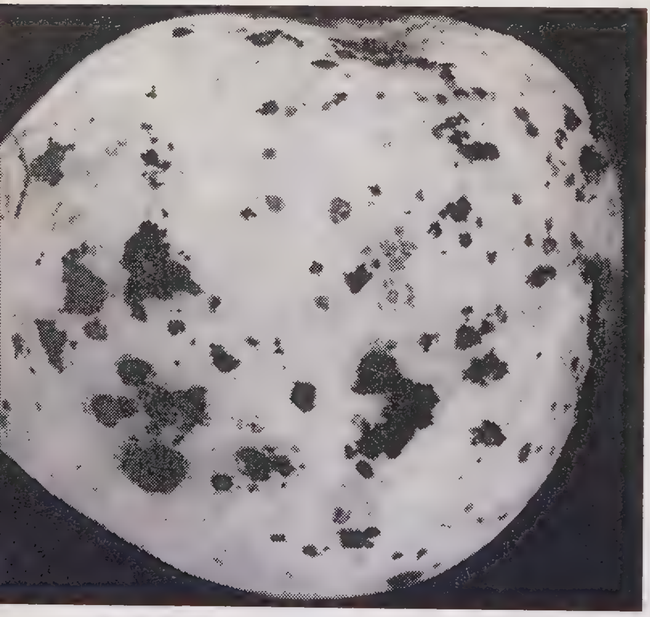


Plate 3: **Rhizoctonia Scab on Potato Tuber.**

Plate 5 (right): **Purple Top Wilt.** Aerial tubers on affected plant.

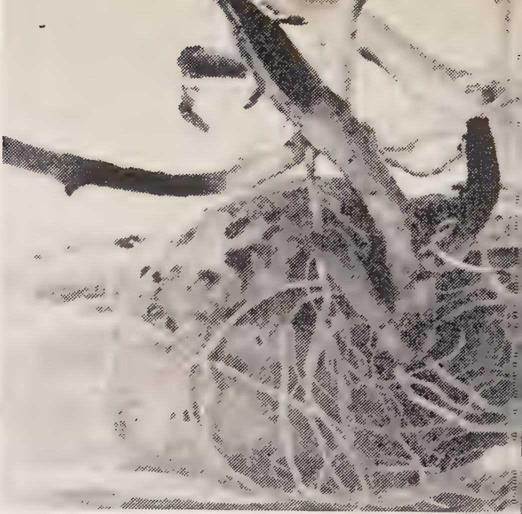
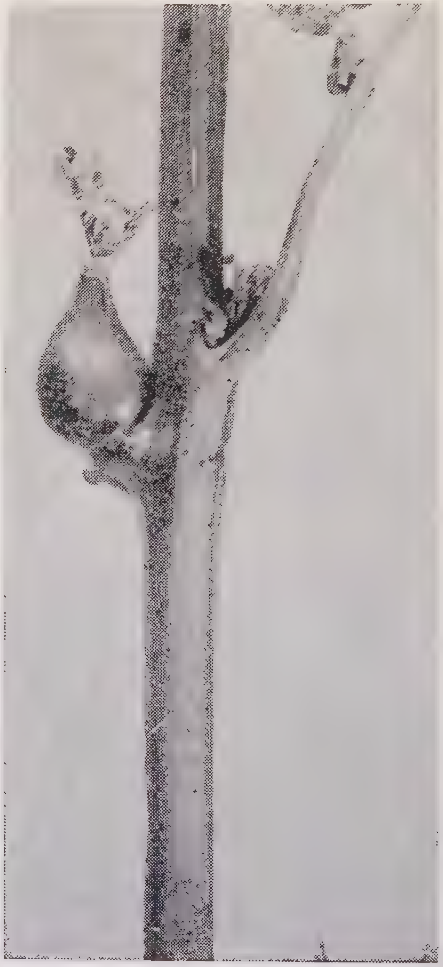


Plate 4: **Sprout Damage Caused by Rhizoctonia.**



CONTROL

Due to the low incidence of the disease since 1956, no recent fungicide trials have been conducted. From other sources it appears that copper sprays are still the most efficient of the ungicides. If organic fungicides such as maneb or zineb are used they must be applied at short intervals. Diseased tubers which may introduce Irish blight into the crop should not be planted.

Powdery Mildew

A fungal disease of lesser importance in south Queensland is powdery mildew. The causal ungus* lives mainly on the surface of the plant tissues and may often be seen as a white powdery growth on the stems and leaf bases of the plant.

No control measures are advocated as the disease is not considered of economic importance.

Fusarium Wilt

Fusarium wilt is the most important of the wilt diseases of potatoes in south Queensland. The Fusarium fungus may persist in the soil to attack subsequent potato plantings.

SYMPTOMS

Fusarium wilt is most conspicuous as the plants approach the flowering stage. The ollapse may be fast and, within a week, an pparently healthy plant may succumb to the disease, yellow, wilt and die. An examination of he root and base of the stem will generally how a breakdown of tissue and a brown disoloration. The discoloration extends well up he inside of the stem and is easily seen if the tem is cut lengthwise or if a leaf stalk is cut lose to the stem. Aerial tubers are frequently ormed in the leaf axils of plants affected with Fusarium wilt.

CAUSE

The fungi† causing this disease gain entry to he root system from the soil or from diseased seed pieces. The water-conducting vessels of the root and stem are invaded and the movement of water in the plant restricted, causing the plant o wilt. Meanwhile there is a collapse of the elow-ground parts.

CONTROL

As Fusarium wilt is normally introduced to a field with infected seed, care in the selection of seed for planting is a primary step in the control of this disease. A further precaution which must be taken to guard against disease being carried on the surface of the seed pieces is to dip all seed in a fungicidal dip prior to planting. The organic mercurial dips are recommended for this purpose.

Once infection has appeared in an area of land, the disease may be expected to increase in severity with subsequent potato crops. Growers would be well advised not to sow potatoes on infected land for a number of years. Harvesting should not be delayed where crops show Fusarium wilt infection.

Bacterial Wilt and Black Leg

Bacterial wilt somewhat resembles Fusarium wilt in its general effect on the potato plant, but the wilting is more rapid and there is less yellowing of the foliage. The internal symptoms produced by it are often different from those of Fusarium wilt. The water conducting tissues do not always become brown in colour but they are filled with bacteria which ooze out as glistening drops on the cut surface of the stem. The tubers from infected plants exhibit a wet rot which, under moist conditions in a bag, spreads rapidly, destroying the whole tuber, and then spreads to neighbouring tubers.

This disease is caused by a bacterium‡ and is of frequent occurrence in Queensland.

The most conspicuous feature of the bacterial disease known as black leg§ is a soft black rot of the stem which extends from ground level upwards for 6 to 12 inches. The tops above the affected stem area wilt and the tubers on black leg infected plants develop a soft rot similar to that which occurs in the case of bacterial wilt. During hot weather bacterial soft rot may cause considerable losses in transport or storage particularly if the tubers have been bruised during harvesting or handling.

The bacteria responsible for these two diseases may persist in the soil for a number of years.

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* *Oidium* sp.

† *Fusarium* spp.

‡ *Pseudomonas solonacearum.*

§ *Erwinia* sp.

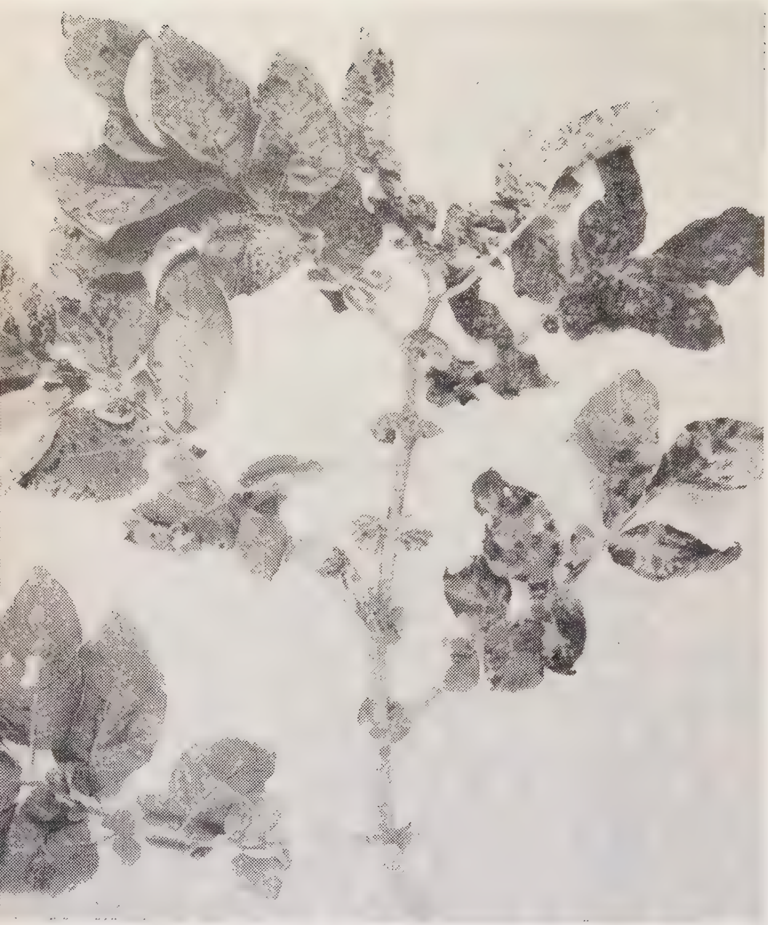

Plate 6: **Spotted Wilt.** Note the symptoms confined to young growth.

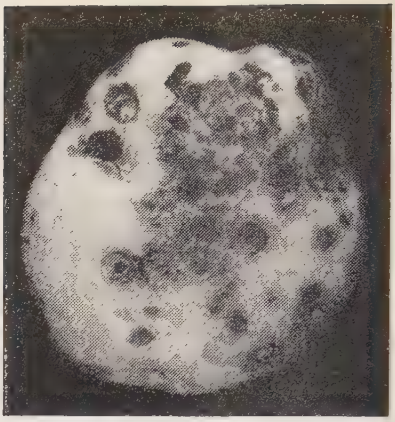

Plate 7: **Potato Scab.**

CONTROL

Control measures for these bacte diseases involve rotation of crops, c in the selection of seed to ensure the of only sound tubers, and good stor conditions for all tubers—especi those to be used as seed. Treatment the seed by dipping in a fungicidal has been found helpful as it reduces amount of contamination introduced the surface of the seed piece. Once ag an organic mercurial dip is suitable removing surface contamination.

Rhizoctonia Stem Rot and Rhizoctonia Scab

The Rhizoctonia fungus* is repo to be widespread in potato crops southern States of Australia. It is of a group of fungi which are able to ensure their surviva soil or plant parts by the production of sclerotes or resting bod

These sclerotes are seen frequently on the surface of s potatoes where they appear as small black bodies (Plate 3). T lumps resemble black soil, but, when wetted, become inten black in colour and do not wash off. When planted in m soil, the fungus germinates, producing a mould-like gro which may attack the potato sprout as it emerges (Plate 4) later, may attack the stalk about ground level. The early affe sprout or stalk often rots away before emerging. A late att may cincture the stem, and the top of the plant subsequently d

A common feature of this disease on growing plants is production of aerial tubers. These swellings, appearing on stems of the plant in the leaf axils are green and useless. may be recalled that the production of aerial tubers occurs

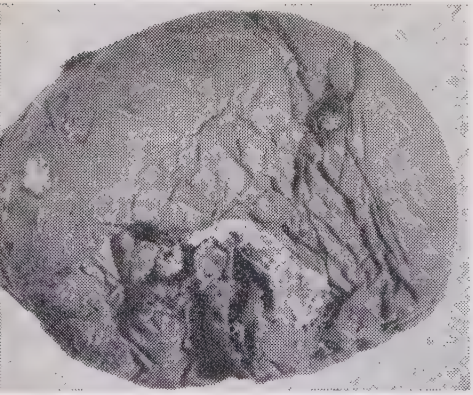

Plate 8: **Fusarium Dry Rot.** Note surface wrinkling of tuber and white fungal growth.

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* *Pellicularia filamentosa* (*Rhizoctonia solani*).

n plants affected with Fusarium wilt. The roduction of aerial tubers is a symptom ssociated with many root or stem disorders f potatoes due either to fungal or virus infection r mechanical damage.

The Rhizoctonia fungus though common in ed consignments, seldom causes serious stand sses in Queensland. Control measures include ed selection and the use of fungicidal dips prior planting. The organic mercurial dips (used so for surface disinfection against Fusarium and acterial diseases) are recommended for the con-ol of Rhizoctonia disease but the tubers should e prewetted for 24 hours and then dipped for 5 minutes with the addition of a wetting agent.

Minor Root and Stem Rots

Two other fungi are occasionally parasitic on e potato in Queensland, one* causing a rot of e base of the stem very similar to that which ccurs in Rhizoctonia infection and the other† rot of the underground portions of affected ants. The former can be distinguished by the resence of numerous white to light-brown loured sclerotia or resting bodies about the size radish seed. The latter possesses brown to ack strands having the appearance of shoe laces. o special precautionary measures are warranted the case of these two rots.

Purple Top Wilt (Autumn Wilt)

Purple top is an important wilt disease of otatoes in South Queensland. This disease iffers from those already described in that it is aused by a virus. The virus producing purple p wilt is considered to be identical with tomato g bud virus and is spread by a leaf-hopper.

YMPTOMS

The symptoms usually develop at the flowering age. The upward rolling of the leaves, particu-rly the leaf tips, is the first symptom noted. his may involve the whole plant which, in a w days, becomes stiff and erect with chlorotic liage, and generally develops a purplish colour, articularly towards the base of the young leaves. requently one stalk only of a hill may be seased.

Most affected plants produce aerial tubers Plate 5); however, this symptom alone cannot be used to diagnose purple top wilt. Frequently plants with root injury from other causes show yellowing of the foliage often with purplish tints in the young growth accompanied by the production of aerial tubers.

The tubers from affected plants have been reported in other States frequently to fail to emerge or to produce abnormal shoots called hair shoots or spindle sprout.

CONTROL

No control measures can at present be suggested for dealing with autumn wilt.

Leaf Roll

Another important virus disease of south Queensland potatoes is leaf roll. This disease is tuber borne and is subsequently spread by aphids.

SYMPTOMS

The most reliable symptom of leaf roll is the upward rolling around the midribs of the lower leaves of the plant. The rolled leaves are coarse in texture and the plants rattle when shaken. The plant has a stiff erect habit and a pale colour which is accentuated by the appearance of the undersides of the leaves which roll upwards about the midrib. The tubers from affected plants sometimes show a brown net discoloration of the water-conducting tissue.

CONTROL

As initial infections generally come from the use of infected seed, control measures involve care in selection of seed potatoes. Where possible, seed should not be saved from infected plantings. Rogueing of an area to be retained for seed is essential to avoid early infections in new plantings. As late leaf roll infected plants are very easily confused with plants suffering from other maladies, particularly plants short of water, the use of certified seed or seed tubers known to be free of leaf roll is strongly recommended.

Mosaic Virus

This is the most infectious of the potato diseases. Mosaic is a virus disease which can be spread mechanically by contact between a healthy and a virus-infected plant.

SYMPTOMS

The symptoms of mosaic virus vary with potato varieties. The majority of varieties either carry the disease without showing symptoms or, when infected, show a mottle between the veins with little dwarfing of the plant, or deformation of the foliage. Despite the mild or undetectable symptoms this virus causes some reduction in yield. The disease is carried over from season to season in the tubers.

---

* *Sclerotium rolfsii.*

† *Armillaria mellea.*

CONTROL

Infection with this virus can be kept to a minimum by the use of certified seed.

Rugose Mosaic

Rugose Mosaic is seldom encountered in south Queensland. However, where plantings are made from infected tubers, very severe losses have been recorded.

SYMPTOMS

An infected plant is stunted. The internodes are shortened and the leaves small. Vein necrosis may be present on the undersides of the leaves and the leaves become markedly distorted and puckered, with down-curved margins. Older leaves frequently shrivel and the plant adopts a dwarfed, stiff, erect appearance. Mottling of the leaves may be present but is usually difficult to see. Some small necrotic spots may be present on the leaves.

CAUSE

This disease is the result of the combination of two virus diseases, one virus being Mosaic (previously described) and the other, virus Y, called streak.

CONTROL

As the disease is carried in the tubers, control measures rely on the selection of seed potatoes from healthy plants. All rugose mosaic affected plants should be rogued from an area intended to be kept for seed purposes.

Spotted Wilt

Another virus disease of potatoes is spotted wilt (Plate 6). Infections of the order of 5 per cent. have been noted on occasions. However, the incidence of this disease is usually much lower. Many growers confuse the symptoms of spotted wilt with those of the fungus disease, target spot.

SYMPTOMS

The first symptoms occur as small dead spots on the young foliage and quite frequently only one stalk from a hill is infected. Subseq development of the disease occurs on the yo growth where the spots may become so nume that they destroy most of the young lea Frequently ring spots (that is, rings of tissue surrounding islands of green) may be on the leaves, leaf stalks or young stems.

This disease resembles target spot to s extent by the "target" nature of the spots differs by the presence of ring spots and the symptoms being accentuated on the yo growth.

CAUSE

As mentioned earlier, spotted wilt is ca by a virus. The virus is transmitted by insect this case a species of thrip.

CONTROL

Infected plants should be rogued where pl ings are to be saved for seed but no other co measures are considered necessary.

Potato Scab

Potato scab is confined to the potato tu and produces cracked and scaly areas depressions on the tuber surface (Plate 7). occasionally do the scabs penetrate deeply there is thus little direct loss of the edible port Scab-affected potatoes, however, have poor k ing qualities because rot-producing organ enter the tubers through the scab blemishes break-down ensues. On this account as we because of their unsightly appearance, all potatoes should be sorted and no attempt to dispose of them by sale in the ordinary

Scab is caused by a lowly fungus* organ which forms a delicate growth on the surface the affected tubers. The scab is the pota reaction to the irritation produced by the in tion. The organism may be introduced to uninfested field on seed potatoes and there sur in the soil for a number of years. Its prese is serious on land having a neutral or alka soil reaction and acidification of soil with sulp has been recommended for its control. This cess is, however, somewhat expensive and has been practised extensively.

CONTROL

Recommendations for the control of this ease involve long rotation of crops, seed select

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* *Streptomyces scabies.*

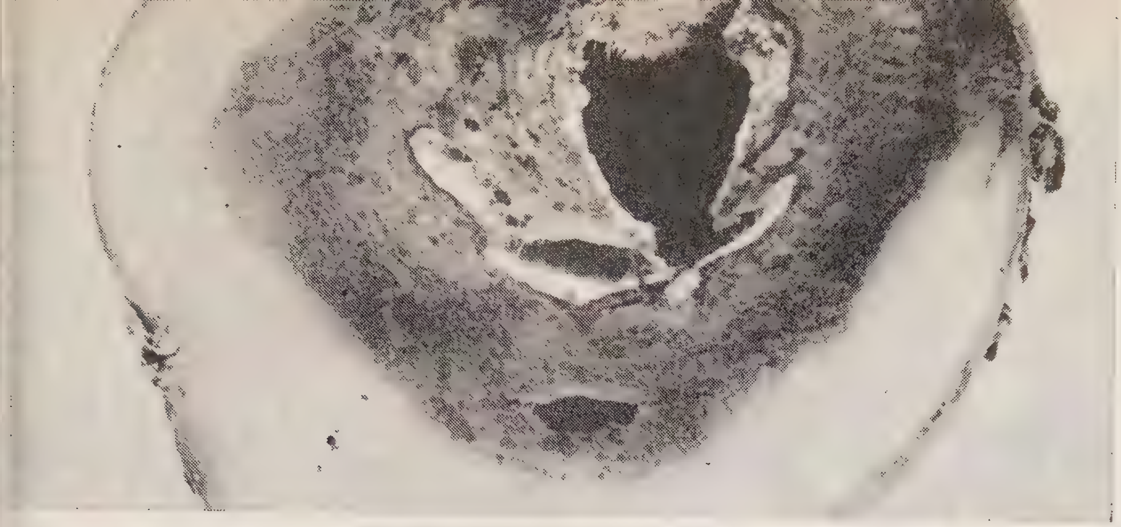
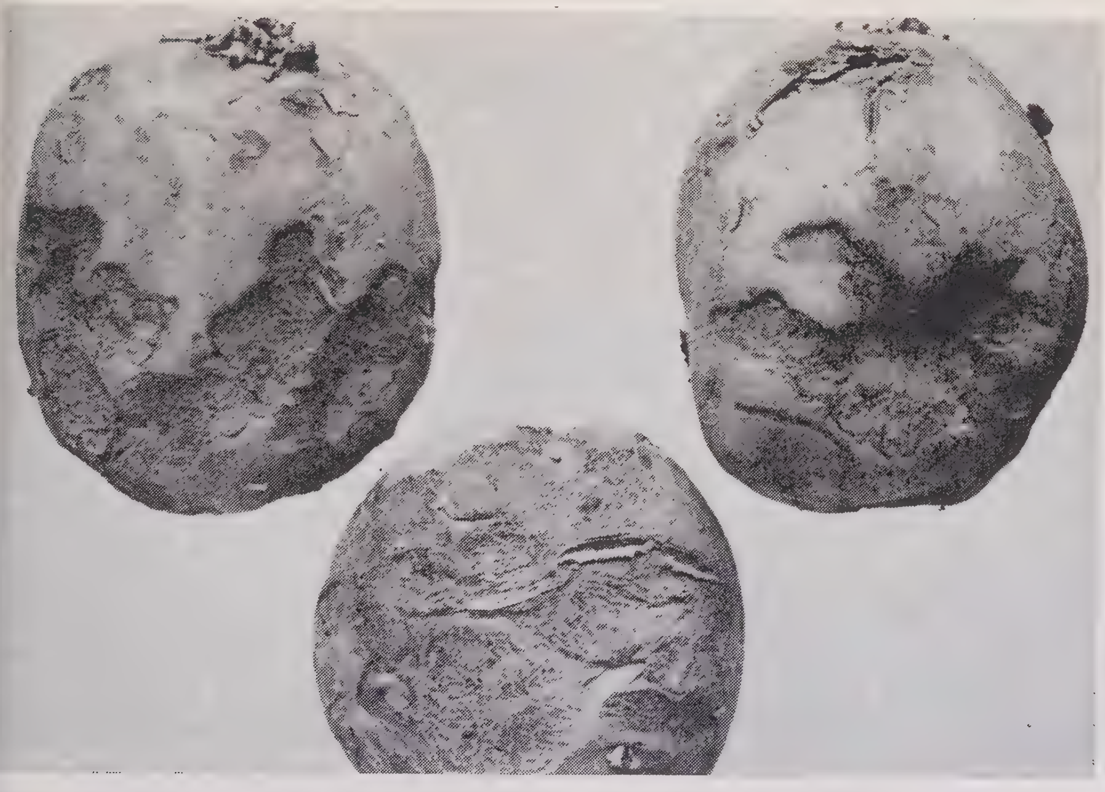


Plate 9: **Fusarium Dry Rot.** Section through tuber showing discoloured flesh and internal cracking.

Plate 10: **Phoma Rot.** Note the "thumb marks."



and seed treatment. If sufficient potato land is available, only one crop should be grown before sowing to lucerne or other crops for 3 or more years when potatoes can again be planted. Seed should be free of any obvious signs of scab and should be treated with a proprietary organic mercury compound. This treatment destroys the organism responsible for common scab and in addition, as mentioned earlier, destroys many other disease-producing organisms which are carried on the surface of the seed tubers.

Storage Rots of Potatoes

Numerous storage rots of potatoes have been recorded. Already tuber rots caused by Irish blight, bacterial soft rot and bacterial wilt have been discussed. In addition to these are numerous rots, many of which follow mechanical injury to the tubers on digging and bagging. Frequently poor storage conditions, particularly those which delay the development of wound cork, are responsible for increased losses due to storage rots.

Dry Rot

Dry rot can be caused by several species of Fusarium including the one responsible for Fusarium wilt. The fungus may gain entry the tuber through the stolon where the plant succumbed to Fusarium wilt or it may g entry at the time of digging or bagging. Dam to the surface of the tuber allows points of en for the fungus until the area becomes corky

The size of the affected area may vary a in some circumstances will involve the wh tuber. The rotted part becomes shrivelled a the surface of the tuber becomes wrinkled gen ally in concentric circles (Plate 8). The surf of the affected area may crack and the fun show as white fluffy blobs. The affected flesh the tuber is brownish black and often cracks c to the loss of water (Plate 9). Finally the tu may be completely permeated with the fun and be mummified and very light in weight

Phoma Rot

The first sign of infection by phoma rot is presence of shallow depressions (the so-cal "thumbmarks") on the surface of the tub These enlarge to a diameter of 1 in. or m and may be somewhat irregular in shape (Pl 10). The skin may show some minor wrinkl

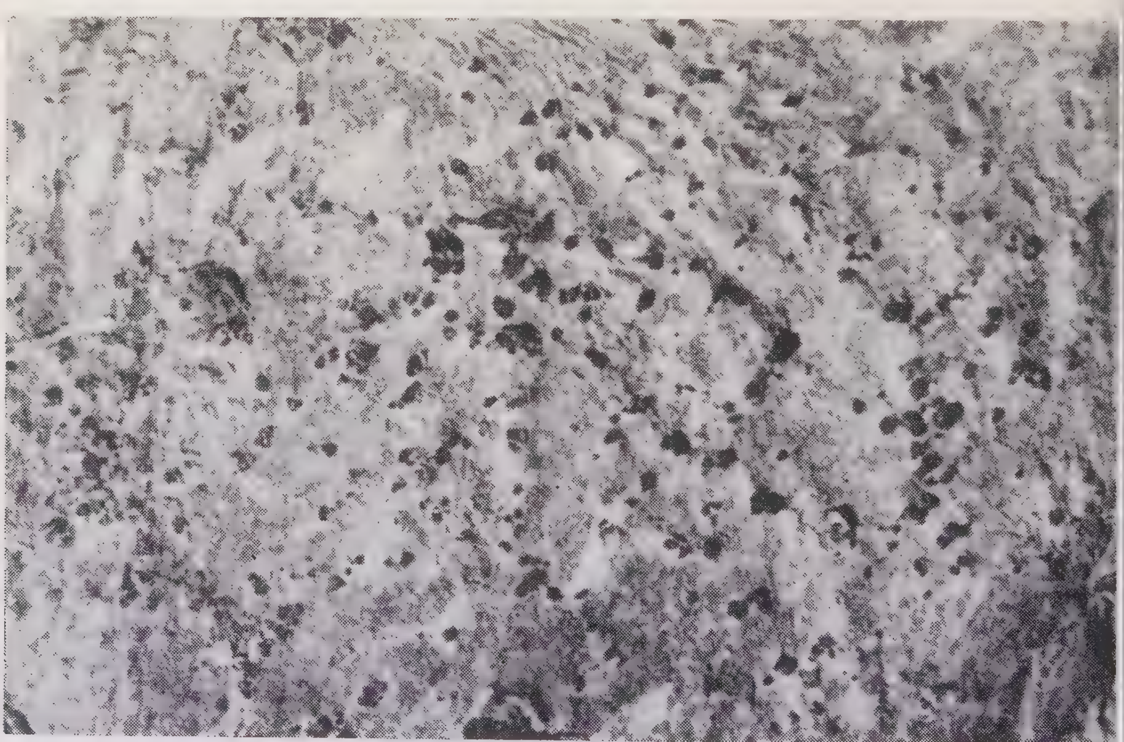


Plate 11: **Phoma Rot.** Showing black fruiting bodies of fungus on surface of tuber.

aracteristically in a network pattern. On cut- ng the affected area, the damage is seen to be allow and generally is darkly discoloured. The ssue is shrivelled and dry.

The presence of a greyish-white mould and numerous pin head, black fruiting bodies nbedded in the surface of the lesion is charac- ristic of the Phoma fungus (Plate 11). This sease is favoured by cool weather and there- re is more prevalent in southern Australia than Queensland.

Careful handling and good storage conditions ill reduce losses from these two rots.

Spindle Sprout

The term spindle sprout is used to describe ibers which produce long attenuated weak prouts (Plate 12). Tubers saved from plants ffected with purple top wilt or leaf roll virus equently show this symptom. Heating of tubers efore or during storage may also result in the roduction of spindle sprout.

Such seed if planted almost invariably results weak growth. Frequently the shoot does not merge above ground level.

All seed showing spindle sprout should be dis- arded at planting time.

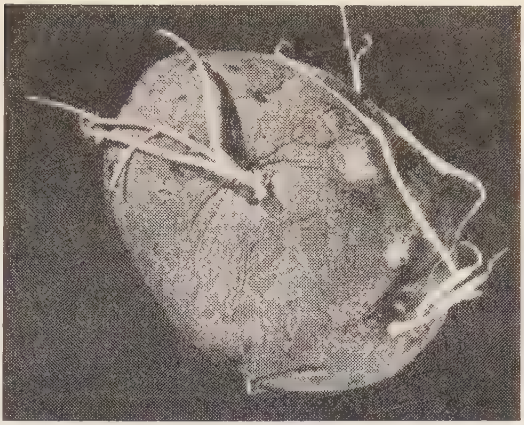


Plate 12: **Spindle Sprout.**

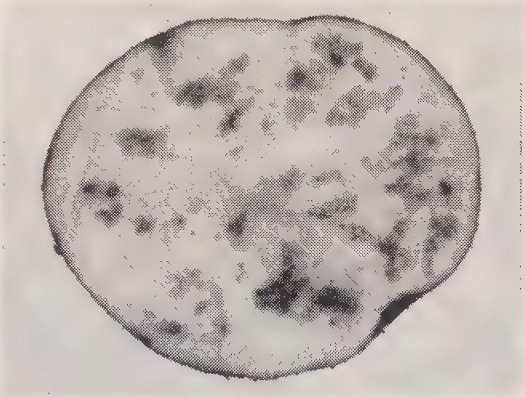


Plate 13: **Brown Fleck.**

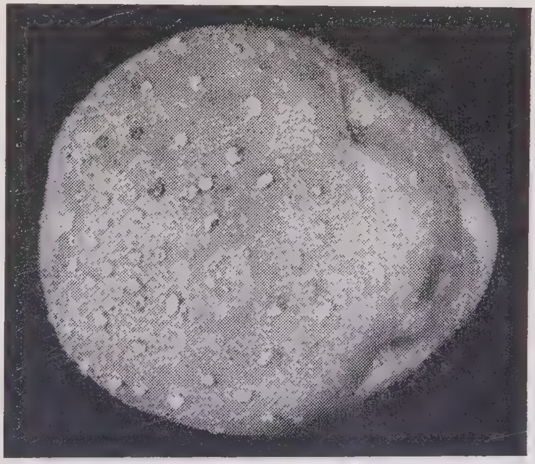


Plate 14: **Enlarged Lenticels.**

Physiological Disorders

Brown fleck, hollow heart, black heart, glassy nd, soft tubers and enlarged lenticels are all aused by physiological disorders.

Potatoes affected by **brown fleck** (Plate 13) re normal on the outside but a number of small ard brown portions of tissue are scattered hrough the flesh of affected tubers. The hard rown portions do not soften on cooking and if t all numerous their presence entirely spoils the otato. No parasitic organisms are present in he affected tissue and, although the cause of the rouble is not definitely known, it is found to be ost common in crops grown in hot sandy soils.

Hollow heart is not discernible on the outside f the tuber but consists of an irregular hollow the centre of the tuber. It is caused by too apid growth and is of no particular consequence.

Tubers affected by **black heart** are quite normal n the outside, but on cutting they are seen to ave a black irregular area in the centre. Black heart is caused by overheating or poor ventilation in storage and this physiological disorder can therefore be prevented by providing better storage conditions.

The central portions of tubers affected with **glassy end** are water-soaked and have a translucent glassy or greasy appearance, particularly towards the stem end. The affected areas are dull in contrast to the crisp white appearance of healthy tuber tissue, and glassy end tubers are frequently referred to as being soapy. The affected portions are deficient in starch and when cooked break down to an unpalatable mush. This physiological trouble is caused by an interruption in the steady development of the plants after the tubers have commenced to form. If the crop receives a check in dry weather, the tubers will stop growing and when rain falls may start into secondary growth or other tubers may form. In either case, the earliest formed tubers or porti of tubers give up some of their starch content the fresh growth and as a result the glassy-e trouble develops.

Where a check in growth near maturity of crop occurs, and at a later date subsequent seco growth of the bushes develops, a **softening of tubers** already formed may occur.

Frequently when excess soil water is present the plants approach maturity, particularly wh the planting is made on heavy soil, the pot tuber may develop **enlarged lenticels** (Plate 1 These lenticels are really breathing pores of potato and under certain conditions show as wh dots owing to a proliferation of their tissue. is not uncommon to find ground rots, both b terial and fungal, associated with this conditi as these enlarged lenticels allow easy entry to r producing organisms.

QUEENSLAND-BANDED SWAMPHEN RECOVERED FROM DUTCH NEW GUINEA

One of the species which is caught accidentally in traps used for wild duck investigations in Queensland is the eastern swamphen (*Porphyrio melanotus* Temminck), also called redbill or bald coot. These birds are banded and released. The repeated recoveries of many of the banded birds of the small, regular, breeding population of swamphens in north Queensland would suggest that most of the birds are resident.

On April 21, 1961, however, a swamphen banded originally at Mt. St. John, Townsville, north Queensland, on December 13, 1958, was shot by a Papuan guard on the ricefields of the Koembe Rice Estate, Koerik, Dutch New Guinea. The distance covered—approximately 1,000 miles—is of interest and indicates that more significance may be given to the other two recorded movements of the species from Townsville (Mt. St. John, November 27, 1958, to Herbert River near Ingham, December 17, 1958; and Mt. St. John, December 13, 1958, to Feluga near Tully, October 4, 1960).

—*H. J. LAVERY, Entomologist.*

An Eastern Swamphen with a Band on the Left Leg. Mt. St. John, Townsville, July 5, 1961.

ed Spider Mites On Strawberries

By J. J. DAVIS, Entomologist.

Red spider mites are the commonest pests acking the foliage of strawberry plants in south- st Queensland where the crop is grown com- rcially. Control by the use of either sulphur kelthane is both safe and effective.

Even when fully grown, these pests are just ible to the unaided eye. The body colour may red, yellow or green. The carmine red lividuals are the most noticeable and from these common name of red spider is derived.

Feeding and breeding take place on the under- f surfaces where all stages in the life history cur together, sometimes amongst fine silky bbing.

The eggs are minute, round and glistening. ey are laid separately but in large numbers ally near the main veins of the leaves. The ung oval-shaped larvae have only six legs and almost transparent. These moult to become ht-legged nymphs and finally adults. The cast- skins shed by the young stages can be seen attered among the mites.

On strawberry leaves, red spiders commence eeding in sheltered places against large veins ar the stem ends. Eventually they spread over whole undersurface.

ature of Damage

Red spider mites feed, in both nymphal and ult stages, by piercing leaf cells. The merous feeding punctures make the undersur- ces blotchy-white or silvery, the foliage becomes rsh and the plants suffer a setback in growth.

Infested strawberry leaves may show purple discoloration on the uppersurfaces along the main veins.

Damage if unchecked can reduce strawberry yields by one half or more. Usually the early crop of large berries is not seriously affected. The later crop of "jam berries" may be greatly reduced and the fruiting period shortened. Well-grown crops are best able to withstand mite damage. Strawberry plants suffering from dry conditions are particularly susceptible.

Seasonal Occurrence

As red spiders may take only 2 weeks to complete a generation they can rapidly increase in numbers. The populations of these pests are in fact liable to rapid increases and equally sudden declines. Natural controlling factors are weather, availability of suitable food plants and predators.

Warm dry weather in early winter and spring favours red spiders. They feed on a wide variety of crops and weeds and therefore are always present in most districts. During early winter the pests first appear in strawberry crops possibly having been transferred there by winds from host plants nearby.

Control

Chemical control of red spider mites on strawberries is often essential, and the use of either sulphur or kelthane is both safe and effective.

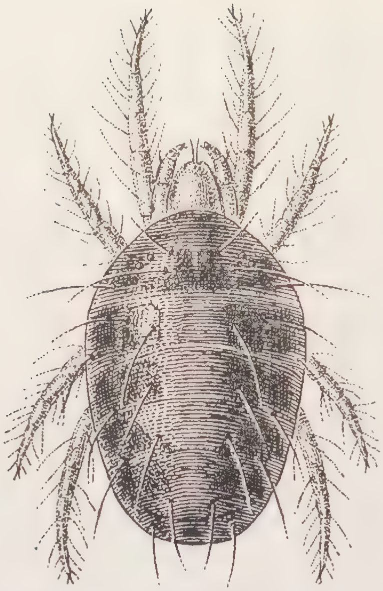


Plate 1: **Red Spider Mite.** Magnified 100 times.

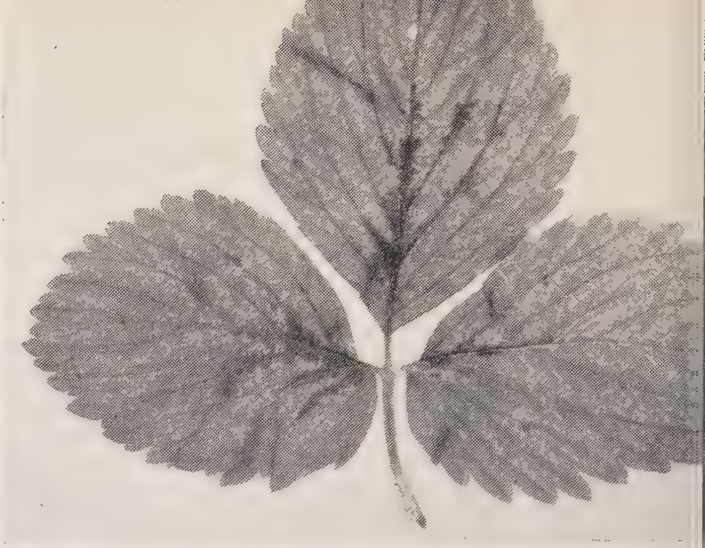


Plate 2: **Red Spider Mite Damage to a Strawberry Leaf, Shown by Purple Discoloration Near Veins on the Upper Surface.**

Sulphur dusts are mixed ready for use, and dispersible powders should be prepared according to label directions. Sulphur is cheap and non-poisonous, and for routine purposes is quite satisfactory when properly applied. It may not, however, kill fast enough during a peak in breeding or when heavy infestations are present. It may also leave a visible residue on the fruit.

Kelthane 0·05 per cent. as a spray is most efficacious against red spider mites, particularly on strawberries. Do not exceed the recommended strength.

Apply either sulphur or kelthane fortnightly from the time the mites first appear. Thorough cover on the undersides of the leaves is essential at all times. Most control failures are due to inefficient application methods, or neglect du busy harvesting periods.

Sulphur and kelthane control red spider m only. If aphids are present substitute a nic sulphate spray for one of the routine applica

Scientific Names of Pests

Red spider mites—

Tetranychus lambi Pritchard and Bak
Tetranychus ludeni Zacher
Tetranychus telarius (L.)

Aphids—

Pentatrichopus fragariae (Theobald)
Macrosiphum euphorbiae (C. Thomas)

* * *

Queensland Year Book, 1960

The 1960 issue of the *Queensland Year Book* retains the same form as previous issues, but the information in the tables and text has been brought up to date.

Copies may be obtained from the m bookstores or from the Statistician's office 10s. each. For postal orders, 1s. 8d. should added.

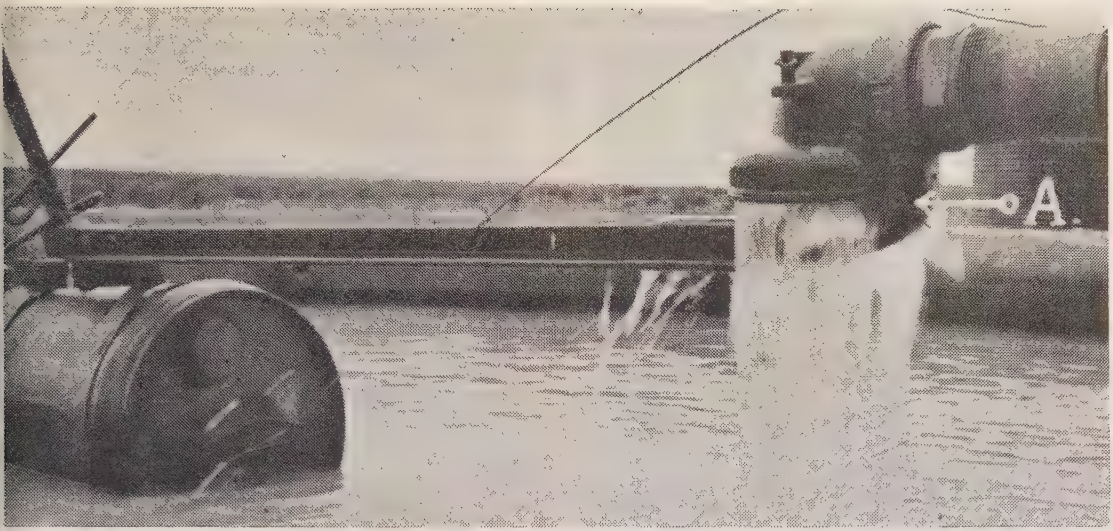


Plate 1: As the water in the storage tank rises to the required height, a flap-type valve, A, partially closes off the water supply thereby creating back pressure throughout the length of the 2 in. delivery pipe line.

Vindmill Cut-Out Works On Back Pressure

R. G. WILSON, Adviser in Agriculture.

A handy water saver is a mechanical self-nding cut-out that operates on the principle of ck pressure built up within the delivery pipe e by the closing of a float valve inside the ter storage tank.

Mr. John Borthwick, of “Whynot,” west of ilpie, made the device entirely from scrap terial, including an old cable winch (any type winch would do).

The need for a mechanical cut-out became creasingly evident on “Whynot” as gusty winds, rticularly during the night, induced a 2,500 l. an hour windmill to pump conserved run-off ter greatly in excess of the homestead storage nk's requirements.

The principle of the cut-out is that as the ter in the storage tank rises to the required ight a flap type float valve A partially closes f the water supply, thereby creating back essure throughout the length of the 2-in. livery pipe line.

The float valve is not a positive water-stop; it acts more or less as a partial “stop.”

As back pressure is built up by the pumping action of the mill, a low tension spring-loaded rubber bucket 1 in. diameter (as used in the motor vehicle wheel hydraulic system) housed within a brass cylinder B forces the attached release arm C forward to eject a sleeved, spring-loaded extension bolt D forward some 3 in.

The cylinder is connected to the rising main, by a $\frac{1}{2}$-in. diameter rubber or nylon hose E, of sufficient length to cope with a 12-in. stroke action of the pump rod.

As the extension bolt D is released (3 in.) it is caught by a spring-loaded catch F attached (as illustrated) to the windmill pump rod G as it makes its downward stroke.

Caught by the “catch,” the “up and down” movement of the pump-rod then winds up the winch H in an ordinary double pawl action—thereby winding the mill tail around and putting

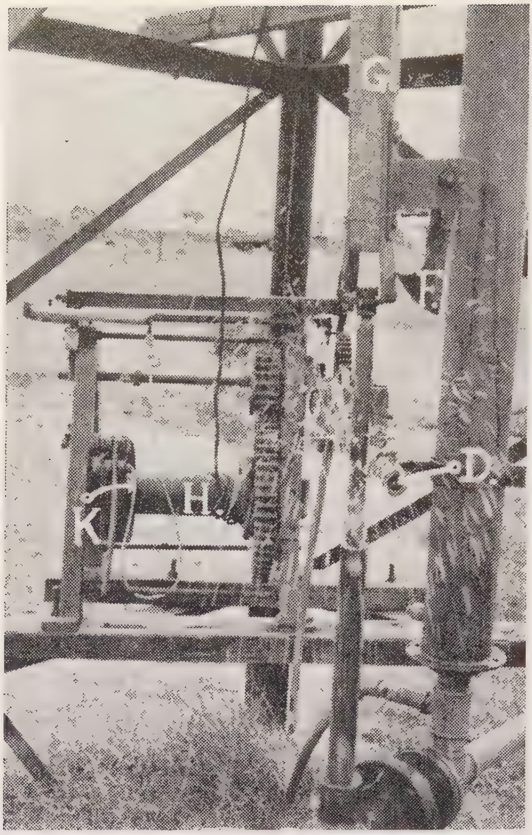


Plate 2: A front view of the cut-out mechanism disengaged. Note the spring-loaded catch, F, attached to the mill pump-rod. The winch, H, and steel cable are in the background. A safety device, K, disengages the rear pawl, J, preventing overwinding and the consequent severing of the steel winding cable on the winch drum.

the mill out of gear. The cable is slowly wound up on the winch drum by the action of the drive pawl I in the "front" and the "stop" pawl J engaged at the rear as illustrated.

As a safety precaution, a ½-in. diameter linen cord K at the furthermost end winds on to the drum as the mill is winched out of gear.

When wound completely out of gear the cord places tension on the lifting arm which then lifts the rear pawl, thereby disengaging the winch and preventing overwinding and the consequent snapping of the cable during windy weather.

When required to put the windmill into gear again this may be accomplished next morning by simply lifting the two pawls (I and J) and allowing the winch drum to unwind and so place the tail into the wind.

Plate 3: Looking down upon the 1 in. diameter brass cylinder, B; the release arm, C, and the spring-loaded extension bolt, D. The cylinder, B, is connected to the 2 in. delivery line by a ½ in. diameter hose, E. The parts, B to D, are motivated by back pressure built up in the delivery line.

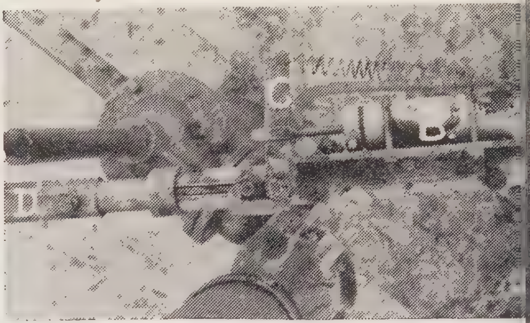
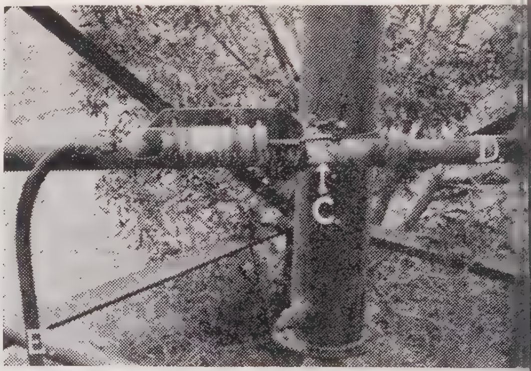


Plate 4: A side view of the release mechanism B, C, D, and connecting hose, E, as illustrated in Plate 2. Note that the extension bolt, D, is being engaged by the spring-loaded catch, F, attached to the windmill pump rod, G, as it makes its downward stroke.



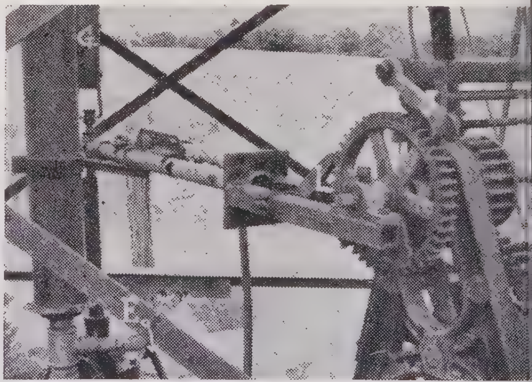


Plate 5: Once the extension bolt, D, is caught by the catch, F, the up and down movement of the pump-rod then winds up the winch, H, in a double pawl action thereby winding the mill out of gear. Note the drive pawl, I, and stop pawl J.

Killing Timber Regrowth With Hormones

By N. D. YOUNG, Agrostologist.

Research work by the Department at "Brian Pastures," the Australian Meat Board's Pasture Research Station near Gayndah, has proved that bloodwood and box can be killed in one treatment using basal frilling and a hormone weedicide.

The pastoral industries in coastal and sub-coastal south-east Queensland are conducted in country which was formerly for the most part open eucalyptus forest. Early productivity was enhanced by ringbarking which improved grass density and surface water. Vigorous regeneration is common and the problem of controlling sucker and seedling growth of many species of these eucalypts is serious, both on grazing land and also on rights of way used for industrial purposes such as power lines and railways. Ringbarking will kill top growth of many species but suckers are frequently produced from below the frill or from ligno-tubers at the base. (See Plate 1). The degree of suckering after ringbarking seemed to depend on seasonal conditions prevailing at the time of, and following, treatment, on soil type, and possibly on subsequent burning practices. Considerable controversy exists among primary producers as to the best method and season for "ringing." Complete successes and failures are claimed for almost every month of the year.

At "Brian Pastures" Pasture Research Station, near Gayndah, investigations were commenced to test the effectiveness of various herbicides in controlling bloodwood (*Eucalyptus dichromophloia*), which was known to sucker badly following normal ringing treatment.

The initial trials using hormones gave poor control. In these experiments the hormones were placed into waist-high frills.

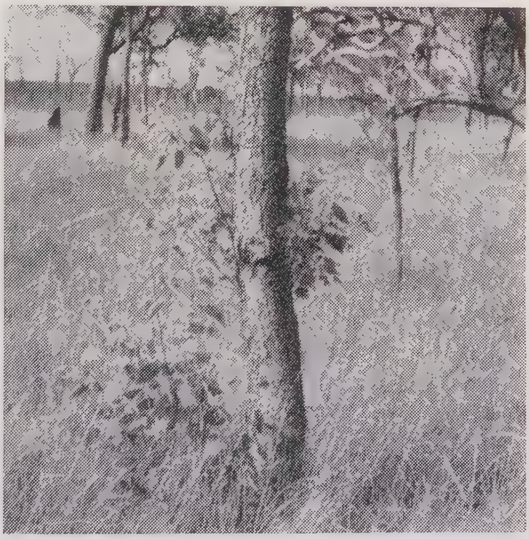


Plate 1

Frill and Basal Suckers which Have Developed on the Main Trunk Following Waist High Ringing of Bloodwood.

Plate 2

A Basal Frill Being Cut at Ground Level.

Further tests were commenced in 1957 for th purpose of answering two questions:

1. What was an effective herbicide?
2. What was an effective application method

Methods used

Bloodwoods with trunk diameters 6 in. t 10 in. were selected for treatment. The first trials in this series commenced in September, 1957 when four methods of application were tested

(1) A complete frill, joining axe cuts approximately belt high, the normal ringing height. This method was called "normal frill"

(2) A similar frill at or near ground level certainly not more than 3 in. above ground level This method was called "basal frill" (See Plates 2 and 3).

Plate 3

A Better Kill Results if all Axe Cuts Are Overlapped.

(3) A similar basal treatment, making no attempt to join all axe cuts but simply making four or five cuts into the trunk of trees—"basal axe cuts".

(4) Boring 4 to 6 equidistant ⅜ in. auger holes depending on the tree size, sloping downwards into the trunk to a depth of about 2 in. at or near ground level—"basal holes".

Chemicals tested

To each of these four methods the following herbicides were applied:

1. No application (control or check).
2. 2,4,5-T butyl ester in diesel distillate.
3. 2,4,5-T butyl ester in water.
*4. A.C.P.-m-177 in water.
*5. Benzac 103A in water.
*6. A.C.P.-m-177 in diesel distillate.
*7. Benzac 103A in diesel distillate.
8. Ammonium sulphamate.
9. Aminotriazole.
10. Diesel distillate.

All trees were individually identified with numbered tags, and records were taken of top growth killed and the extent of post-treatment suckering.

This trial was repeated three times to examine seasonal effects beginning in—

1. September, 1957, at the commencement of spring growth.
2. February, 1958, at flowering.
3. August, 1958, during winter when the trees are relatively dormant.

From these trials it was clearly apparent that the basal frill was very much superior to any other treatment method and that 2,4,5-T butyl ester was by far the most effective of the herbicides tried. Where a combination of basal frill and this chemical was applied, 100 per cent. kill resulted at each treatment.

The winter application of August, 1958, was slightly inferior to spring and mid-summer treatments when considering all herbicides, but with effective chemicals no seasonal difference was apparent.

Concentrations tested

Further trials to examine the most effective concentration were commenced in 1958. Three concentrations, 1 per cent., 2 per cent. and 3 per cent., of 2,4,5-T butyl ester were used in each of the three basal treatment methods, that is, basal frill, basal axe cuts and basal holes. The results were clear-cut. Basal frilling was much superior to the axe cuts and holes and there was little difference between any of the concentrations when combined with the basal frill method.

In a subsequent trial employing the basal frill method, 1 per cent. and 2 per cent. concentrations were almost equal and only slightly inferior to 3 per cent. Kills of better than 90 per cent. were recorded for all concentrations using this method. Two fl. oz. were as satisfactory as 3 fl. oz.

Time of Application

As the time of application was considered to be an important factor affecting resulting kills, 50 bloodwood trees were treated in the first week of each month for 16 months commencing January, 1960. The method used was basal frill with 2 fl. oz. of 2,4,5-T butyl ester at 2 per cent. concentration. It is still too soon to make final evaluations with regard to post treatment suckering, but a count in January, 1961, of treatments applied up to August, 1960, shows very satisfactory kills at least for the months January-August, as listed in Table 1.

TABLE 1

PER CENT. KILLED FOR JANUARY-AUGUST, 1960, TREATMENTS

January	100 per cent.
February	100 per cent.
March	84 per cent.
April	100 per cent.
May	96 per cent.
June	92 per cent.
July	100 per cent.
August	92 per cent.

---

*These chemicals are trichlorbenzoic acid derivatives not available commercially and supplied for experimental purposes only.

Plate 4

The Type of Tap Used at "Brian Pastures" with a Quick, Positive Snap On-Off Action.

Final evaluation of this trial will not be made until autumn, 1962, but present trends look promising. This would mean that timber treatment could proceed from late summer through the autumn and into the winter months, when pressure of normal station work such as dipping usually lightens off.

Effect of soil type and topography

These trials have been conducted on widely varying soil types and topographical areas. On heavy brown clays of basaltic origin, trials were conducted on the shallow soils of ridge tops and steeply sloping spurs, as well as on areas of deeper soil. Ridges and flats of granite type soils of much lower fertility were also included. Soil types within these ranges appear to exert no influence on the percentage of kills.

Costs

At present prices, the treatment cost approximately 1d. a tree. Trials using sump oil and mixtures of sump oil and diesel distillate with 2,4,5-T butyl ester have commenced and if successful this carrier will lessen costs. With the chemicals used, water has proved a quite unsatisfactory carrier.

The method described has also proved efficient for controlling regrowth of poplar box (*Eucalyptus populnea*) on "Brian Pastures", and reports from other properties in the Burnett are promising with regard to control of blue gum, spotted gum, and narrow-leaf iron bark.

Although 1 per cent. appears to give kills almost as satisfactory as 2 per cent. and 3 per cent. the use of 2 per cent. is recommended for initial use in a new district. When 2 per cent. with basal frilling is found to be effective in your area then reducing the concentration to 1 per cent. would be worthwhile. This would further reduce costs.

Plate 5

A Bend in the Delivery Pipe Allows Easy Application of the Hormone.

Practical Use

Treatment of timber regrowth by this method on a commercial scale commenced at "Brian Pastures" this year. The system evolved uses a 3-man team, 2 axemen, and one poisoner, using a knapsack spray. The spray is equipped with a snap on-off tap and the delivery stem is bent at an angle of 30 deg. at the nozzle. A spray tip designed to deliver a solid cone of spray is used (See Plates 4 and 5).

The incorporation of a vividly coloured marking dye in the diesel distillate is recommended. To minimise walking, the paddock to be rung is treated in strips 2 to 3 chains wide and the use of a dye facilitates identification of treated trees along the strip edges. The positive action of the snap-on tap saves wasteful use of herbicide. Sufficient to just wet the cut surface of the frill is adequate.

Where treating younger, thinner stands too small to frill, the method usually employed of swabbing the cut stump is satisfactory.

Thus if 2,4,5-T butyl ester at 2 per cent. in oil is applied to a complete basal frill the old practice of "sucker-bashing" will be outdated. This treatment gives excellent kills on bloodwoods, and box, and from observations is probably effective against many other hardwood species.

All evidence from trials at "Brian Pastures" suggests this method is independent of soil type and the time of application.

Queensland Pocket Year Book

The 1961 Pocket Year Book is now available rom the Deputy Commonwealth Statistician, 2 George Street, Brisbane.

This publication is designed to provide a onvenient pocket-sized reference to the State's fficial statistics. Its 128 pages contain detailed ables on such diverse subjects as population, ducation, social welfare, livestock, agriculture, actory production, minerals, building operations, inance, shipping, wages and employment.

The following are a few samples of the wide ange of information about Queensland:

1. At 31st March, 1960, there were 5,756,975 beef cattle in Queensland, almost half of the Australian total.
2. The net enrolment in Queensland schools increased from 155,257 to 240,532 in State schools and from 41,106 to 68,132 in private schools between 1949 and 1959.
3. The gross value of goods and services produced by Queensland factories in 1958-59 was £435,349,000.
4. In 1960, new dwellings valued at £32,108,000 and other new buildings valued at £23,800,000 were completed.
5. There were 344,198 broadcast listeners' licences and 67,337 television receivers' licences current at 30th June, 1960.

What We Can Learn About Silage Qualit

By K. W. MOIR, Senior Chemist, Animal Research Institute.

When we speak of silage quality, we refer broadly to those characteristics that appeal to the senses of sight and smell. We would say of a silage that has a sweet but sharp smell, an olive-green colour and a moist appearance, that this is a good quality silage. The underlying factors producing these characteristics are less apparent.

This appraisal of quality has nothing to do with the nutritive value of a silage. Silage quality and nutritive value are largely separate considerations.

By sight and smell it is possible to grade good from poor quality silage. Only chemical analysis can accurately define silage quality intermediate between good and poor, and show where and why a silage fails to reach top quality in spite of reasonable care during silage making.

Achieving Silage Quality

Ensiling is a fermentation process. Organisms which are always present in any environment break down carbohydrates (sugars) to organic acids. These acids, which in a good silage are predominantly lactic and acetic acids, are capable of preserving the ensiled crop for long periods. The most desirable type of fermentation takes place in the absence of air. The exclusion of most of the air in the silo is achieved by tightly compressing the crop to be ensiled.

A good quality silage results when—

1. The crop is sufficiently compacted. The amount of pressure required to compact silage depends upon:

(*a*) The degree to which the crop is choppe
Finely chopped crops compress m
easily.

(*b*) The moisture content of the crop. Mo
crops compress more easily than d
crops. Excessive moisture, howeve
may cause the silage to sour unless the
is good drainage away from the silo.

2. There is sufficient available carbohydra
for optimum fermentation. The desired carb
hydrate content is achieved by:

(*a*) Using crops such as maize, sorghu
sugar cane, sudan, which have a hi
sugar content when relatively matu
Even so, these crops should be chopped
ensure compaction.

(*b*) Finely chopping crops of only modera
sugar content to increase the availabili
of soluble sugars. Grasses and cro
which are relatively immature have on
a moderate sugar content. A mixed pr
duct comprising a high carbohydrate cr
and a grass or legume may also have on
a moderate sugar content. Current studi
are indicating that the increase in avai
able carbohydrate by fine chopping
small, but the favourable influence o
compaction is of major importance.

(*c*) Chopping and adding molasses to cro
with a low carbohydrate content. Thes
include legumes, young crops and grasse
generally. Such crops are characterise
by high protein levels.

3. There is good drainage in the silo, particularly if the moisture content of the crop is high.

4. The silo is adequately covered. Seepage from rain may cause the washing away (leaching) of valuable nutrients. Further, the resultant loss of acids means poor preservation.

The Meaning of Chemical Tests

Some or all of the following tests may be made on silage to determine its quality:

1. Ratio of lactic acid to acetic acid. In a well-ensiled crop, the fermentation which results in acetic acid formation is quickly suppressed and fermentation resulting in lactic acid formation supersedes. In a good quality silage, the ratio of lactic to acetic acid is greater than unity—that is, there is more lactic than acetic acid.

2. Ratio of amino acids to volatile bases. Amino acids are products resulting from breakdown of protein. This is a normal fermentation process. If the conditions for fermentation are not satisfactory, organisms break down amino acids to volatile bases such as ammonia. In a good quality silage the ratio of amino acids to volatile bases is greater than 1:1 and the quantity of volatile bases is small.

3. Total acidity. A high total acidity means that conditions have been favourable for fermentation. A high total acidity ensures the preservation of the silage for long periods. A good silage has a total acidity in excess of 300 units. (The unit of acidity is equivalent to 1 ml of $\frac{N}{10}$ acid per 100 grams.)

4. pH. This is a chemical symbol which means acid concentration as distinct from total acidity. A low pH means that the acid concentration is high. A low pH in the silage means that conditions have been favourable for fermentation. A very good silage has a pH below 3·8. Silages with pH between 3·8 and 4·2 can be good quality silages, providing the total acidity is high. At a pH much above 4·2, the silage is lacking in some desirable attribute.

Much Still to Learn

It is a relatively simple matter to ensile crops with a high sugar content provided the silage is sufficiently compacted in a well-constructed silo. It is not quite so simple to obtain top quality silages from crops of low sugar content.

The ensiling of grasses and legumes to give products of optimum quality has not been investigated fully under Queensland conditions. We have yet to know how much molasses should be added to different crops, the sugar content of which is dependent on the stage of growth at harvesting. We have yet to know to what degree these crops should be chopped to yield the best products. We have yet to know much more about silages prepared from grasses and crops harvested by different types of commercial harvesters such as flail and cutter bar types. Possibly, additives such as metabisulphite or mineral acids, which are used extensively overseas, may have a place in silage making in Queensland in the future.

The application of quality tests to silages when relatively complete information is available on type of product, stage of growth and method of preparation is providing useful information on procedures which, under Queensland conditions, may be expected to give better quality silages in the future.

Chemical Analysis Explains Failures

Failure to prepare a top quality silage may result, even if care is taken during ensiling. This can be due to lack of knowledge of the moisture and carbohydrate levels in the crop. Obviously, the time factor prevents analysis before ensiling but tests on the finished product supply many of the answers. On the basis of these answers, better products can be expected in the future.

A low total acidity and a poor ratio of lactic to acetic acid indicate insufficient available carbohydrate for optimum fermentation. Possibly, the crop was too immature. Certainly, molasses should be used as an additive with this type of crop at this stage of growth at the next silage making.

A high moisture content, a high pH and a sour smell indicate too moist a crop in a silo with inadequate drainage. Wilting may be necessary before conserving such crops in the future.

A low ratio of amino acids and volatile bases and a caramel smell indicate insufficient compaction and the need for finer chopping and better consolidation for such crops in the future.

Top Quality Is Desirable

Apart from the personal pride in making a good product, there are a number of economic reasons why every endeavour should be made to obtain the best possible quality silage.

In a poorly compacted silage there is appreciable loss of both protein and carbohydrates. If the silage is excessively moist or if the silo is inadequately covered, valuable nutrients are lost in the effluent. But the biggest disaster of all would be if, in time of drought, stock would prefer to starve rather than eat a silage which had turned mouldy through lack of protection, or sour either through lack of drainage in the silo or because there was insufficient carbohydrate for complete fermentation.

A good silage can be kept in the silo indefinitely to be fed out at the most opportune time with no fear that it will be unacceptable to stock.

How to Take Silage Samples

In sampling, the aim is to take a portion which is, as far as possible, typical of the silage in that silo. In a trench silo, portions of the silage may be taken at different parts from the open face. Mouldy material at the edges is discarded both in feeding and sampling. In a tower silo, it is necessary to remove an amount which would fit into a chaff bag and re-sample from this amount. If possible, samples from any type of silo should be taken from the relatively large amounts which are available at the time of feeding out.

Naturally, it is essential that the sample should not change during the inevitable delay in transit to the laboratory. Changes are minimised if as much air as possible is excluded and if the sample is forwarded by the quickest route. The best container is a 5 lb. tin with a press fitting lid. The silage sample should be compressed and rammed as tightly as possible into the tin, the tin filled completely and the lid firmly sealed. If the sample has to be held for some little time before transport is available, the tin should be kept in a refrigerator. On receipt at the laboratory, the sample is deep frozen pending analysis.

The sample should be clearly labelled and forwarded to the Biochemist, Animal Research Institute, Yeerongpilly. The accompanying letter of advice should contain the following information:

1. Farmer's name and address.
2. Crop used for ensiling.
3. Stage of growth of the crop when harvested.
4. The amount of molasses added, if any.
5. The class of stock to which the silage is to be fed.
6. The proposed method of use, that is, the amount to be fed daily and what supplementary feeds are available.

£40 An Acre From Cotton

Yields averaging 1,269 lb. to the acre of seed cotton were obtained at the Hermitage Regional Experiment Station during 1960-61, from a replicated varietal trial comparing nine varieties.

The climate of this particular part of Queensland, with its relatively short frost-free season naturally demands that a successful cotton variety should combine earliness of fruiting with the ability to develop a large crop of bolls quickly during any periods of stress in summer. Dixie King and Deltapine 15 each produced more than 1,400 lb. an acre which is very good for rain-grown cotton in the conditions experienced this year.

The trial was not planted until late in October, 1960, and low temperatures in November retarded growth somewhat. Plant growth was further restricted in January but fruit formation was accelerated in the wide temperature range experienced at that time.

Rains were received in time to prevent undue loss of squares from the prolific formation that had developed, and the following dry conditions were ideal for the maturing cotton.

The yield of nearly 1,300 lb. an acre represents a net return to the grower of approximately £40 an acre after paying for insecticidal spraying and for the four necessary cultivations. This compares favourably with the return from a crop of Alpha grain sorghum, planted in an adjacent block on the same day as the cotton, and which yielded 60 bus. to the acre.

—*R. B. BYGOTT, Experimentalist.*

Silage Cuts Sheep Losses At Glenmorgan*

Glenmorgan sheepmen are finding in sorghum silage the answer to the feed shortages that cost them heavily in sheep losses every dry spell. Short-term droughts are common in this 22-inch rainfall district, and severe, protracted droughts occur from time to time.

Typical of the fodder-conscious graziers in the Glenmorgan district are Messrs. F. J. and R. J. Allpass, of "Paloma," south of Glenmorgan. These men claim that silage making on "Paloma" paid for itself in the 8 months ended last February.

They said their 1,200-ton reserve of sorghum silage, stored in trenches, saved them heavy sheep losses in the last 5 months of the 1960-61 drought. By feeding silage at up to 10 tons a day, they were able to maintain 6,000 sheep for a loss of 1 per cent. This loss they considered normal as it was due largely to fly strike.

The 1957 drought cost "Paloma" some £2,500 for bought feed, and still 900 sheep perished. After this, the Allpass family turned to silage-making as a means of saving sheep without the heavy expense of buying fodder.

"Paloma," a 9,000-acre sheep property, was first taken up as an all-timber block in 1927. It normally carries about 4,500 sheep and some cattle. Cultivation was first begun in 1957, and today 500 acres are under oats and sorghum. This area of cultivation is being increased as further clearing is in progress.

Though silage has been made from both Sudan grass and Sorghum almum, the Allpass family prefers the higher-yielding more palatable sweet sorghums. Six earth trenches with capacities ranging from 200 to 300 tons are in use.

It is worth noting that Sorghum almum, though it made spectacular growth in the first year, was a disappointment in its second year.

As a cheap, one-man unit with few parts to go wrong, the flail type forage harvester has proved satisfactory. Silage is removed from the trenches by blade-dozing and then with the use of a modified Si-loader "grab" that cost £98. The grab will handle about 3 tons of silage in half an hour.

The experience of these graziers has been that rain during silage making is no problem. Once a trench remained open while some 4 in. of rain fell but the silage was not spoiled.

The Allpass family has found that cattle take readily to silage, but sheep need about a week to get used to it. At first, baled wheaten hay is fed out with the silage as a lure but even then some sheep will refuse to eat. An early start to feeding is found necessary so that the sheep are used to the feed and are eating their full ration before they become weak.

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*Compiled from a report by Mr. R. G. Wilson, Adviser in Agriculture at Toowoomba.

Mr. Allpass Snr., said the Lee family of "Coomoomie," a neighbouring property, had pioneered agriculture, sown pastures and silage-making in the Glenmorgan district. It was from the experience of the Lee family that he obtained much of his early knowledge of silage making.

Sown Pastures, Too

Messrs. Allpass are also actively developing an area of buffel grass pasture on "Paloma." In the last 3 years they have co-operated with the Department of Agriculture and Stock in establishing a pasture hobby plot. The aim of this was to find a means of developing their phosphorus deficient box and bulloak country.

Nine commercial perennial grasses and three legumes were tested with and without fertilizer. These were given no special care in management. The plots were usually eaten bare at each grazing, especially during the last drought.

Results since 1959 have shown that th Gayndah, American and Biloela buffel gras strains are well suited to this country.

Lucerne and barrel medic have also performe satisfactorily, especially in plots fertilized wit superphosphate. The residual effect of the super phosphate has been striking, and yields have bee up to three times as high as from the untreate areas.

Green panic, blue panic and Rhodes gras mixed with lucerne and barrel medic appear t have a definite place on the brown clay-loa belah-type soils.

The hobby plot and an adjacent planting o Gayndah buffel sown at the same time are als paying for themselves with cheap seed. A harves of 250 lb. of seed was taken off 8 acres in 1960 and 10 acres yielded about 500 lb. this season.

Plate 1

Good Feed for Sheep. Buffel grass excels on the brown sandy-clay-loam soils of the poplar box-bulloak country in the Glenmorgan district.

Messrs. Allpass plan to use this seed to establish 100 acres of mixed buffel-lucerne-barrel medic pasture next season. This includes oversowing a thinned 2-year-old stand of sorghum almum.

There seems to be a definite place for improved pastures in this area. Certainly graziers in the Meandarra-Glenmorgan district are showing a great deal of interest.

Hobby plot results from the Hannaford properties "Blythelands" and "Greenfields" and roadside plots are consistent with the findings of 9 years' experience at "Coomoomie" and 3 years' experience at "Paloma."

Grazing results from paddock records at "Coomoomie" show that sown pastures compare favourably with annual fodder crops. Pastures have the added advantages of protecting the soil, controlling weeds, making regrowth after fire and producing feed when no crops are available.

The pioneering efforts at "Coomoomie" and "Paloma" in pasture improvement and agriculture on 22 in. rainfall country have already shown that this is no gamble. The rewards of foresight and enterprise are very real. What has been done on these properties can be repeated by other graziers on similar soil types in that district.

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O'Sullivan, Con., "Navillus", Greenmount
O'Sullivan, P. W., "Navleigh", MS 371, Greenmount
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Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boona

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Goddard, B., Inverell, Mt. Tyson, via Oakey
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Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office Gympie

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Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah
Superintendent, Marsden Home for Boys, Station Rd., Nth. Boov

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Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
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Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Hereford

Messrs. Wilson & McDouall, Calliope Hereford Stud, Calliope

Poll Shorthorn

Leonard, W. & Sons, Welltown, Goondiwindi

Stone Cleaner For Disc Ploughs

By **R. G. WILSON, Adviser in Agriculture**

Here is a simple, effective way to minimise stone jamming in twin-disc ploughs when cultivating stony land. This inexpensive idea was developed by Mr. W. H. Graham, "Goodwood Stud", Westbrook.

Mr. Graham claims that in the cultivation of his sloping, stony paddocks he came up against the consistent, frustrating problem of stone-jamming in his twin-disc plough. These blockages nvolved much lost time in repeated freeing of the stones jammed between the twin discs. The stones were picked up from the front of the discs, carried around to the top, and became jammed against the jumper-arm, thereby locking the discs.

In some very stony sections of the property it was not uncommon to stop four and five times in one round of the paddock. Since fitting the flat, mild steel cleaning arms, Mr. Graham has disced four stony paddocks, and had to stop only twice to free stone blockages.

Material—How Fitted

Plates 1 and 2 show the type of attachment Mr. Graham developed.

"A" is a piece of flat, mild steel 10¼ in. long by 2½ in. wide by ⅜ in. thick. A single hole of ¾ in. diameter is drilled at one end of the attachment to fit the jumper-arm bearing bolt. At the same end of the attachment, a portion of the arm is cut away and shaped to fit the top of the bearing housing.

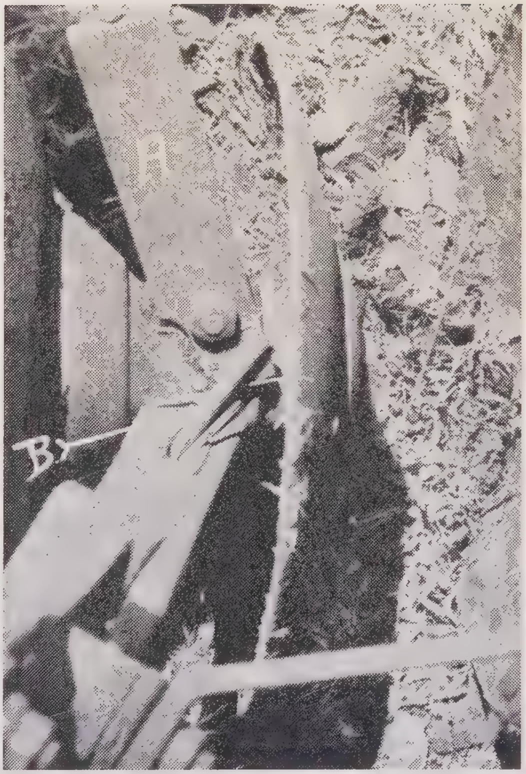


Plate 1: **Looking Down from Above.** Twin disc plough showing position of stone cleaner attachment on plough jumper-arm. "A" illustrates the 10½ in. x 2½ in. x ⅜ in. mild steel plate. "B" shows ½ in. round mild steel arm to prevent side movement.

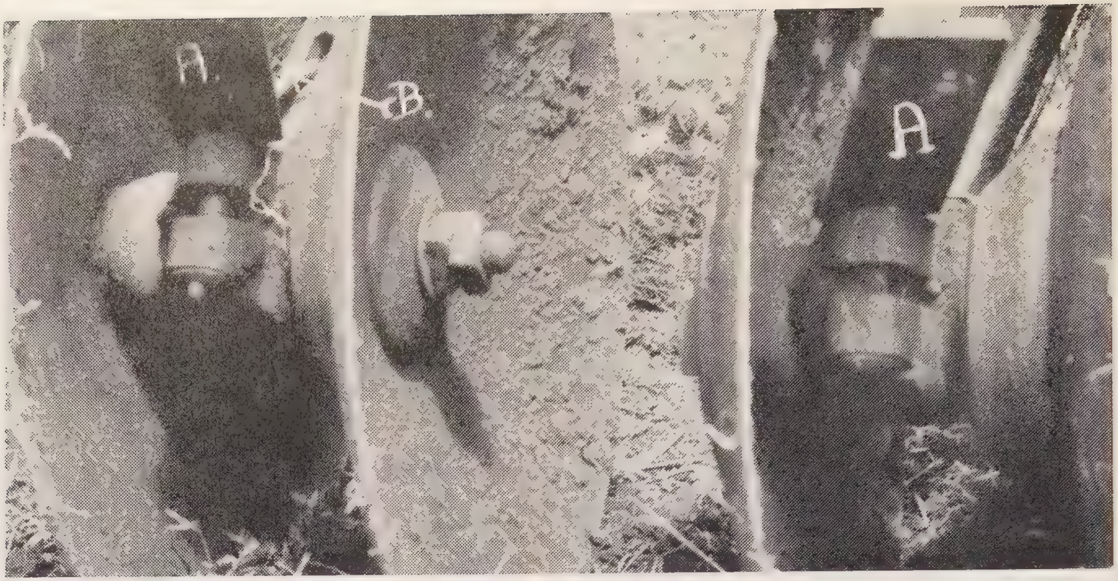


Plate 2: **Lower View of Attachment "A" and "B" Fitted to Jumper-arm Bolt.** Note how "B" enters the elongated moulding hole of the jumper-arm.

Also attached to that end is a welded piece of shaped ½ in. round, mild steel "B"—some 5 in. in overall length. This round material is shaped to fit into the elongated moulding hole of the jumper-arm. This is to prevent side movement of the cleaning attachment.

Besides minimising stone blockages, the cleaner arm attachment is also claimed to be effective in cutting down soil and trash build-up in the discs.

The cost to manufacture the attachment arm off the farm is quoted as 10s. each arm.

A Bonus From A Pasture Investment

Unusually dry seasons like the one experienced this year show up pastures and pasture management practices in their true light. Some features of a pasture of green panic and Glycine at the Kairi Regional Experiment Station are worth reporting.

The pasture mixture was planted in a deep red loam early in 1955. Contour banks were put in, and mowing for weed control was carried out for a year or so. The result has been an excellent mixed pasture for more than five years. It has been well-stocked, and regularly grazed, but not "flogged." No fertilizer has been used. Since the initial weed infestation at establishment, the pasture has remained weed-free.

The contour banks helped retain the topsoil, especially in the early life of the pasture. Since then, the pasture has played its part. The dense sward, with the underlying layer of organic matter, allows rain to soak in where it falls, keeps the soil cool and prevents undue evaporation. This year, with a summer rainfall of less than 25 in., there were still good supplies of soil moisture for use during the dry winter and early spring months.

An unexpected bonus was revealed when careful measurements were made of the growth during the winter months of 1960 and 1961. Though the green panic made only a small contribution, the Glycine, generally regarded as a summer-growing legume, gave very useful amounts of leafy growth, comparing favourably with that which could be expected from white clover under irrigation.

A severe frost would have robbed us of our bonus, showing that the perfect legume has not yet been found; the whole thing merely emphasises the importance of another kind of investment—fodder conservation.

The potential of Glycine for winter production is being studied in detail, and more will be written about it at a later date.

—*P. G. TOW, Agronomist.*

This Farmer Overcame Siratro Shortage

By N. W. DOHERTY, Adviser in Agriculture.

Trials have shown that the pasture legume siratro may fill a need of south Queensland pastures.

But seed is scarce! It is impossible, at this stage, to purchase seed from commercial interests for testing in new areas or for commercial sowings in the areas where it has already been proved of value.

Gympie district farmer, Mr. C. Fryar, of Glastonbury, wanted to test the legume on his own property and he wished to conduct his test under conditions that would be applicable to normal field practices.

That type of test required a grazing block and there certainly wasn't enough siratro seed available for a paddock size sowing.

All he had, in fact, were twenty-four seeds which he had obtained from the Department of Agriculture and Stock.

Mr. Fryar planted these seeds in a small seed-increase plot and obtained several distinct germinations of seed. Three plants—the first to germinate—were allowed to remain in the plot, plants obtained from later germinations being transplanted to another plot.

The three plants in the original plot grew rapidly and showed a tendency to climb. Mr. Fryar then erected a trellis upon which the plants climbed, flowered and set seed. The seed pods were harvested as they matured.

Those three plants yielded over 30,000 seeds in the first autumn and are expected to provide a further harvest in the coming spring.

The seed that is already on hand will be sufficient to establish a small grazing plot in the coming season and a further series of sowings will be performed as each seed crop is harvested in the future.

Later, by the time commercial supplies of siratro seed become available from commercial seed growers, Mr. Fryar, through his early trials, will know whether or not he should enter into large scale planting of the legume.

Perhaps you, too, have considered the possibility of using a small seed increase plot to obtain seed for trials associated with your pasture improvement programme?

Judging by Mr. Fryar's experience, 10,000 seeds per plant, the scheme has definite possibilities.

Plate 1

Siratro Growing on a Trellis on Mr. Fryar's Property. Three plants yielded over 30,000 seeds.

Hybrid Grain Sorghum Seed

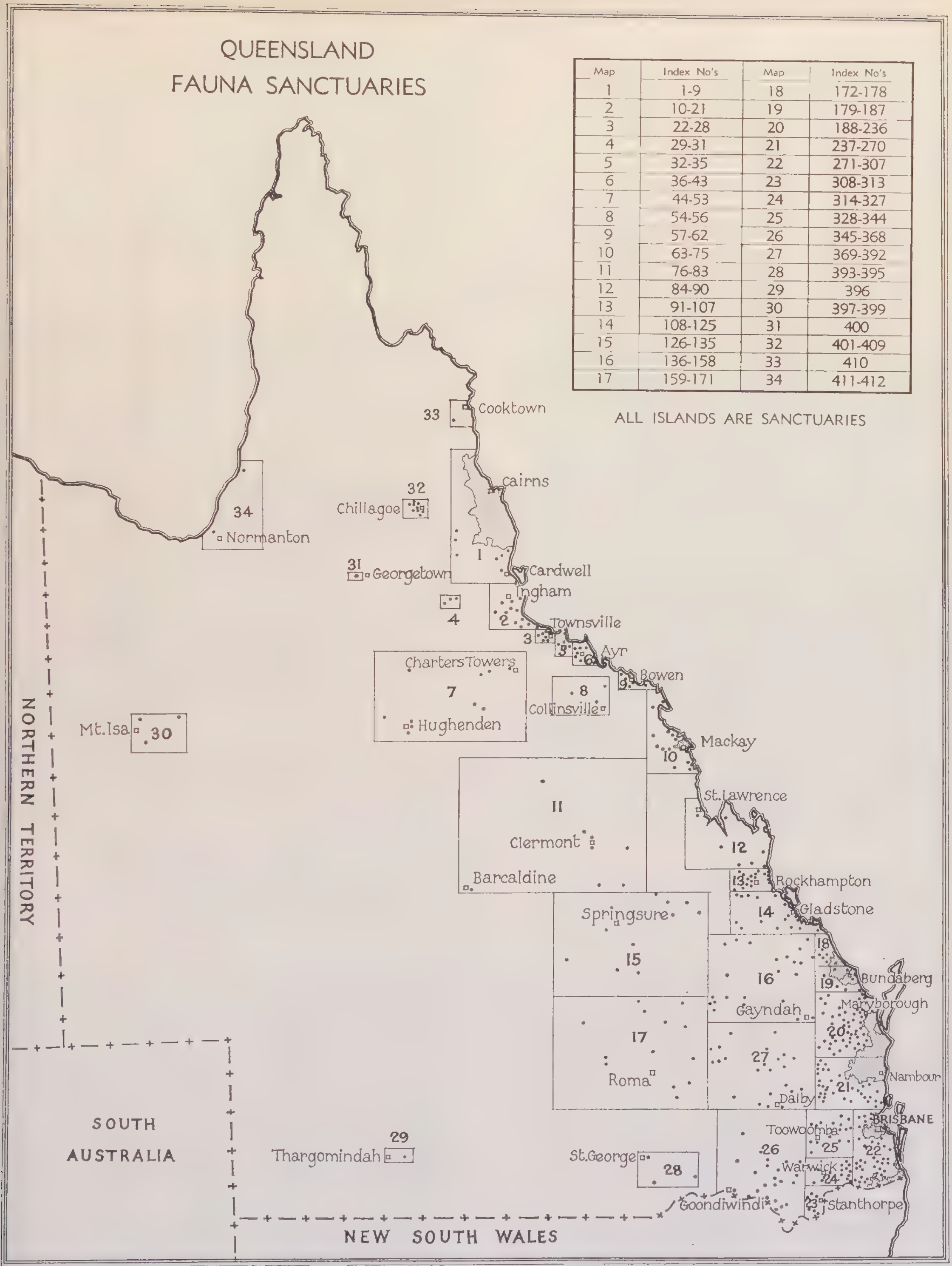
Skilled Queensland farmers grew 4,200 bushels of hybrid grain sorghum last season. This seed, sufficient to plant 31,000 acres, will be used for wide-scale testing of the new hybrid varieties next season.

The Agriculture Department sees in hybrid grain sorghum an opportunity to increase yields by some 25 to 30 per cent. While a number of hybrids are being made in Queensland, some are direct copies of American hybrids, and others are new local combinations. Most promising varieties in last season's trials were Texas 610 and Texas 630 and an unnamed Queensland-bred hybrid, the product of a cross between Combine Kafir-60 and Alpha, the leading Queensland variety.

These hybrid varieties gave promising yields both last season and this, in plantings on experiment stations and on commercial farms.

Parallel with the breeding and testing programme, a scheme to train selected growers in the tricky technique of producing hybrid grain sorghum seed is proceeding. Twelve farmers grew 210 acres of cross-breeding plots in the season just ended. The 31,000 acres that can be planted with seed from these plots is about 15 per cent. of the normal grain sorghum sowing in Queensland.

—Dr. L. G. MILES, Director of Agriculture.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Warwick
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Thargomindah
NORTHERN TERRITORY
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7	44-53	24	314-327
8	54-56	25	328-344
9	57-62	26	345-368
10	63-75	27	369-392
11	76-83	28	393-395
12	84-90	29	396
13	91-107	30	397-399
14	108-125	31	400
15	126-135	32	401-409
16	136-158	33	410
17	159-171	34	411-412

Large Sanctuaries Are Delineated by Stippled Areas: Positions of Others Are Indicated by Dots.
(From the Queensland Fauna Sanctuary series by C. Roff, Fauna Officer.)

Brucellosis-Tested Swine Herds (As at 8th September, 1961)

Berkshire

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilston Park", Pittsworth
H. M. State Farm, Numinbah
H. M. State Farm, "Palen" Stud, Palen Creek
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., 225 West st., Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains", M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young, (Jnr.), W., Kybong, via Gympie

Large White

Assenbruck, C., Mundubbera
Baker, R. L., "Baroma", Glenapp, via Rathdowney
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Butcher, Dr. B. J. & Parnwell, A. J., Plunkett Rd., via Tamborine
Campbell, J. W., "Bunya", Bell
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Coulsen, B. L. R., Wondai
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
Glasser, D. H., "Yagaburne", Goondiwindi
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields',, Murgon
Hickson, K. L., "Warree", Tableland Rd., Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, M.S. 74, Clifton
Horton, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Larsen, H. L., "Oakway" Stud, Kingaroy
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Rosevale, via Rosewoo
Mack, A. J., "Culzean", Mundubbera
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P., & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Pigger Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Sedgwick, F. G. & J. E., Mundubbera
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Trim, R. A., Gold Creek Rd., Brookfield
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Regional Experimental Station, Kairi
Salvation Army Training Farm For Boys, "Canaan" St Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Cooper, G. J., Neumgua
Coulson, B. L. R., Wondai
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn", M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzean", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Alexander and Lundie, "Vanda", Biddeston
Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Burnett, E. V., "Glenden", Tabooba, via Beaudesert
Carmichael, D. J. & J. P., "Junelea", Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Coulson, B. L. P., Wondai
Coulson, Mrs. H. M., Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crawford, R. J. and Sons, "Inverlaw", Kingaroy
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla", Killarney
Hickson, K. L., "Warree", Calliope
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jarvis, O., Wondai
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., 225 West St., Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R. Ascot, via Greenmount
Nielsen, B. J., "Glen-View", Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton", M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Port Curtis Co-op. Dairy Assn. Ltd., Stud Piggery, Biloela
Powell, R. S., "Kybong", Gympie
Radel, R. M., "Turua", Coalstoun Lakes
Rosenblatt, G., "Rosevilla", Biloela
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Trim, R. A., Gold Creek Rd., Brookfield
Weier, V. F., "La Crescent", M.S. 544, Clifton
Young, R. & C., "Dudley Park", Biggenden

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Lantana Poisoning

By O. H. BROOKS,

Assistant to the Director of the Division of Animal Industry

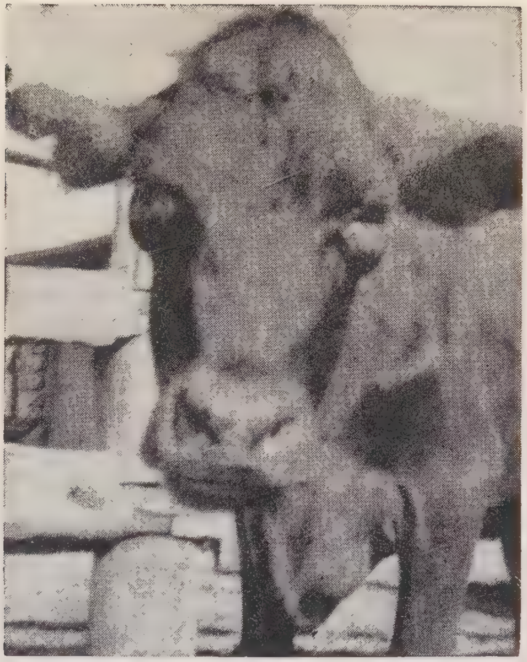

Plate 1

This Severe Case of Lantana Poisoning Shows a Typical Swollen Muzzle with a Raw Surface, Swollen Eyelids and Thickening of the Ears.

Lantana poisoning is confined usually to ungry cattle introduced to infested areas. It ay also occur during periods of drought and ooding, especially amongst young stock.

The toxic or poisonous principle of lantana auses photosensitisation (sunburning) of skin, nd liver damage. Small quantities of leaf, as ttle as 2 to 3 lb., may be enough to cause deaths eaten within 12 hours. The toxicity of the af appears to vary considerably with the season nd climate. Both the red- and pink-flowered arieties are poisonous in central and northern ueensland, whereas only the red-flowered variety toxic in the south.

Symptoms

A wide range of symptoms can arise from lantana poisoning depending upon the age of affected cattle, the amount and rate of intake and the degree of toxicity of the plant according to location and season.

However, the more advanced cases of lantana poisoning are recognised readily by the typical skin lesions of sunburn.

When hungry cattle are involved, some may die within 48 hours, while others will show obvious poisoning. They will refuse to eat and will display abdominal pain. Grinding of teeth, stamping, kicking at the belly, and depression are common features.

Within a few days the typical lesions of sunburn appear on the muzzle, ears, teats and light-pigmented areas of skin. The eyelids become swollen and remain almost closed to avoid sunlight. Affected animals seek shade and stand motionless with the head hung low. Cud chewing ceases and the animal loses condition rapidly due to dehydration (loss of body fluids). Cessation of bowel movements leads to severe constipation after preliminary scouring.

Due to constant licking of the muzzle the surface becomes raw and the condition is referred to as "pink nose".

Affected animals refuse to move from shade. A painful condition of the feet, referred to as laminitis, causes a stiff, painful gait. The animals make no attempt to feed (hand-feeding is usually of no avail). This is due to the painful muzzle and the severe degenerative changes in the liver. The intake of water is excessive.

According to the severity of the liver damage, a close examination will reveal jaundice and the passage of reddish brown urine which is voided frequently. This discolouration arises when there is loss of function of the liver and the breakdown products of the blood stream normally excreted by the liver as bile are passed out through the kidney when the accumulation is excessive.

On post-mortem examination one of the most noticeable features is the *gross enlargement of the gall bladder* which often resembles a footba instead of an organ about the size and shap of a pear. The liver is enlarged, friable an usually bronze-coloured, due to bile congestion The kidneys are inflamed and the urine usuall dark brown with considerable sediment. Th tissues underlying the skin and throughout th abdominal organs are yellow from jaundice.

Treatment

There is no specific antidote for lantana poisoning. Usually cases have reached the stage c sunburn before they are recognised, which woul be at least a week following the eating of lantana By this time there is considerable liver damage and treatment is of limited value.

However, many severe cases have been save by careful nursing. If possible, affected animal should be given constant shade, preferably in hay shed or garage.

To relieve the liver damage and provide energy drenching with sugar and eggs is helpful. Calve would require 1 lb. sugar and 3 eggs daily whil mature cattle could be given this amount morning noon and night.

Constipation must be overcome by drenchin with large quantities of liquid paraffin. Calve should receive 1 pint daily while mature cattl require 1 gal. daily until the constipation has bee relieved. In very severe cases of constipatio enemas of soapy water using 2 to 3 gal. for matu stock may be necessary.

Queensland Hybrid Maize Forges Ahead

Maize growers will get the best Queensland-bred hybrid seed yet produced, and they will get it for the next season's planting, the Minister for Agriculture and Forestry (Hon. O. O. Madsen, M.L.A.) has announced.

Already ranked as the leading certified hybrid maize seed in the Commonwealth, Queensland seed is being further improved by the introduction of a voluntary grading scheme. Grading means that all the seed in each bag is of uniform size.

Besides making the sample more attractive and allowing farmers to buy uniform lines, grading the seed into uniform sizes has an important practical advantage. Using graded seed, a grower needs to make the settings on his planter only at the start of sowing. He can use these settings for the whole sowing without the risk of plantin either too heavily or too lightly.

Mr. Madsen said the grading scheme wa introduced voluntarily by the Queensland Cert fied Hybrid Maize Growers' Association in th 1960-61 season. At the request of the Association, it is being implemented by the Standard Officer of the Department.

The seed is graded into three sizes for fla grains and two sizes for round grains. First c the new graded seed will be available for th maize planting this spring and summer.

Last season was a good one for seed production. Fifteen thousand bushels of hybrid maiz seed, sufficient to plant at least 84,000 acres, wi be marketed for the next season's crop. All c it is being graded.

eekeeping In Queensland

C. ROFF, Adviser In Apiculture.

**The beekeeping industry is developing steadily in Queensland, and successful beekeepers
e those with both practical and theoretical knowledge of the subject. All phases of beekeeping
ust be considered before any investment is made in bees and equipment, and these phases are
tlined in a series of articles of which this is the first.**

An abundance of nectar-secreting flowers and
ourable seasons for production and gathering
nectar make Queensland a suitable place for
keeping. The major portion of the industry
confined to the south-east of the State with
readily accessible market. The principal dis-
ts are Moreton, Darling Downs and Wide Bay,
ile other important areas are centred on
ckhampton and on the Atherton Tableland
late 5).

Trees such as Eucalypts, Tristanias and Mela-
cas provide the bulk of the harvest, while
und flora, an important source in other parts
the world, play only a minor role (see "The
ney Flora of South-Eastern Queensland" by
T. Blake and C. Roff). Urban and rural devel-
nent involving tree clearing has resulted in a
dual decline in the amount of honey produced
the more closely settled areas, and significant
lacement with ground flora is unlikely. On
other hand, reafforestation projects are of
reasing importance, and State Forest Reserves
prized by commercial beekeepers as apiary
es.

There is, however, still room for expansion of
keeping in many areas as every year through-
Queensland large amounts of nectar are not
rvested.

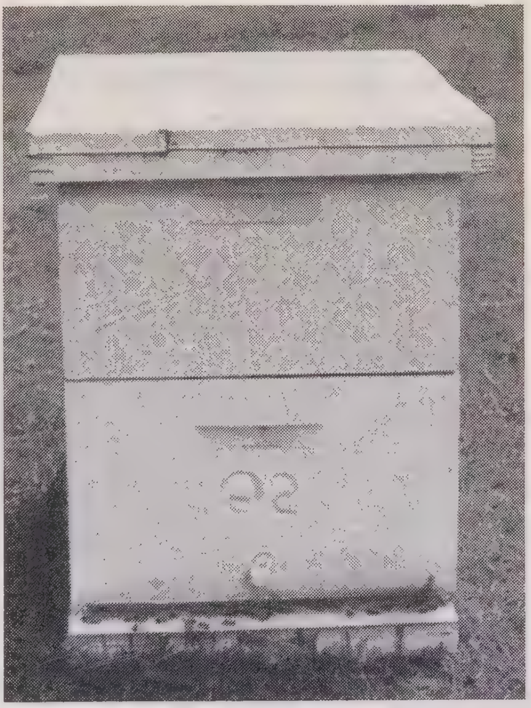

Plate 1

Hive of Bees Comprising Top Cover, Honey Super, Brood Chamber, and Bottom Board.

Plate 2
A Four Frame Nucleus.

INCOME

Interest in beekeeping stems from the type of outdoor work entailed, and the financial returns, which can be discussed only in general terms as income is dependent on variable and unpredictable factors such as availability and abundance of nectar and pollen-producing plants, favourable weather, knowledge and skill of the beekeeper, the number of profitable hives maintained and market fluctuations.

The main source of income is from the sale of honey and beeswax. Some specialists rear colonies and queen bees for sale, and other apiarists provide bees, on a rental basis, as a pollination service for farmers and orchardists.

A beekeeper's income is not fixed, and fluctuates from season to season. It must be remembered that even in the best districts the honey crop is a failure in some seasons and consequently commercial beekeepers should have sufficient capital to tide them over these periods.

The number of colonies maintained by a b keeper ranges from 1 to 1,500, but only a sm number is owned by the majority. So hobbyists and part-time beekeepers progress and become successful in, the commercial fie

An efficient beekeeper with a minimum assistance can manage, and make a reasonal living from, 300 colonies which are usua dispersed as out-apiaries each of at least colonies.

BEE STINGS

A person in good health has or gradua acquires an immunity to bee sting poison af having been stung a few times. This immun greatly reduces after-effects such as swelling a soreness, until finally the effect is not particula noticeable although a seasoned beekeeper alwa feels for an instant the pain of a sting. The r of ill-effects is greatly reduced if the sting removed promptly. It should be scraped o because pulling and twisting tends to sque the contents of the poison sac into the wound.

Proper clothes, a protective veil, and a kno ledge of bee behaviour will assist in limiting t number of stings received. Persons sensitive stings should not work bees.

Plate 3
Hiving a Swarm.

COMMENCING WITH BEES

he beginner should not obtain colonies until ne knowledge of bee behaviour and management has been acquired either from literature or working with a successful operator. Even h this limited experience two or three colonies l be found sufficient during his first season, ich should commence in spring. The work- of a large number of colonies by a beginner en results in heavy losses.

eekeeping may be started by purchasing a colony or a nucleus, by hiving swarms, or, ith previous experience, by cutting nests from es.

ying a Full Colony

btain a full colony of bees, consisting of od chamber and honey super (Plate 1) locally, as to avoid long-distance transport. Observe se other important considerations, that—

1. The colony is of a recognised race of bees.
2. The hive parts are well painted and preserved.
3. The frames hang level and are equally spaced.
4. The comb in the frames is straight and contains mainly worker and not drone cells.
5. Six to nine standard frames are covered by bees.
6. Five to eight standard frames are filled with brood.
7. There is strength and vigour in the queen as reflected in the amount and compactness of the brood and by the manner in which the eggs have been deposited in the cells. (Eggs scattered over a large comb area instead of being laid compactly indicate a poor or failing queen.)
8. There are at least 20 to 25 lb. of honey in the colony, that is, four to six standard frames filled with honey.

Purchasing a Nucleus

A nucleus is a small colony of bees on three of four standard size frames of comb (Plate 2). For a beginner the chief advantage in purchasing a nucleus is the ease of handling. On arrival, the frames have only to be placed in a standard hive with additional frames of foundation and a feeder of sugar syrup.

Plate 4

Bee Nest Cavity Exposed by Cutting Out a Flitch of Timber.

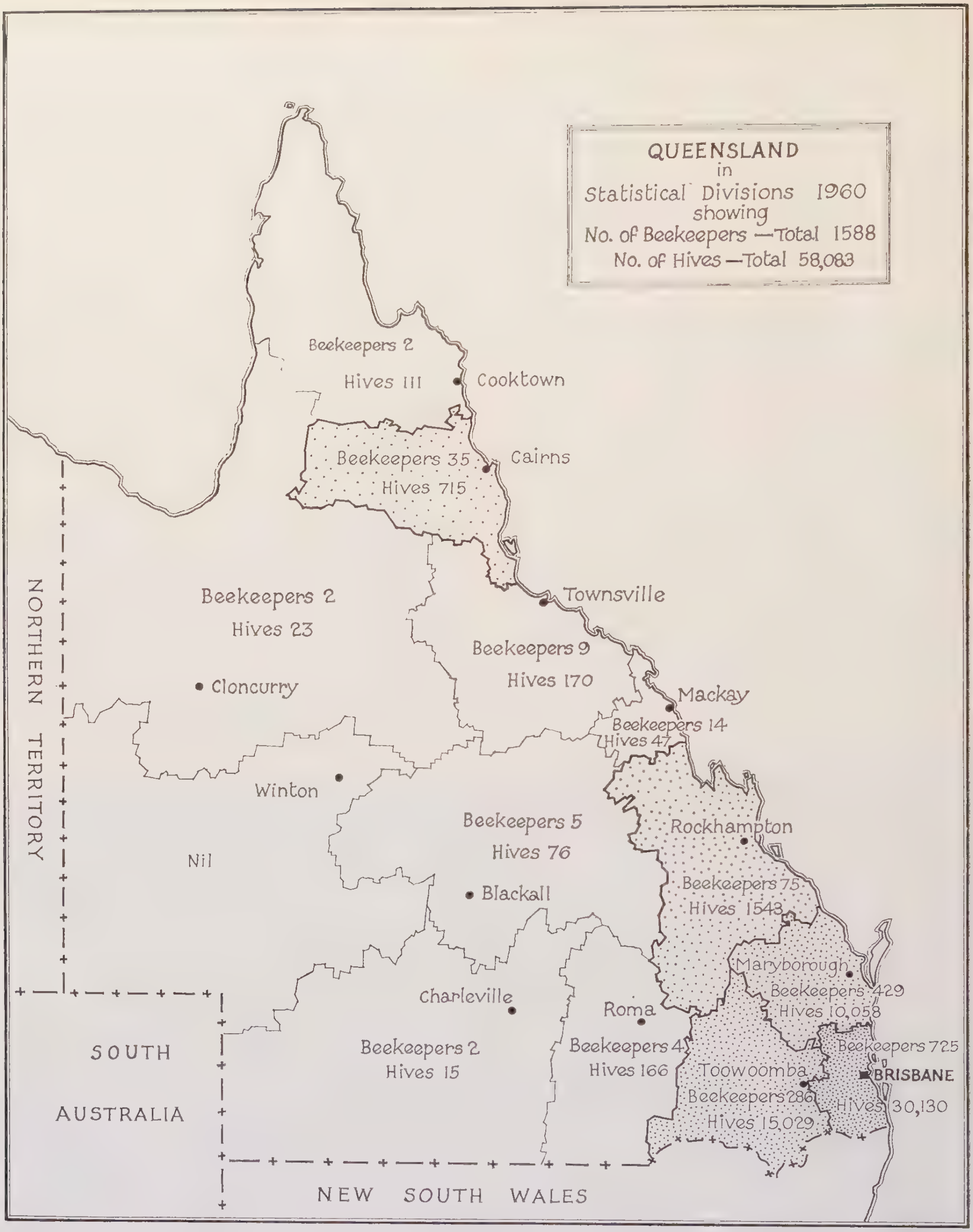
QUEENSLAND
in
Statistical Divisions 1960
showing
No. of Beekeepers —Total 1588
No. of Hives —Total 58,083
Beekeepers 2
Hives 111
Cooktown
Beekeepers 35
Hives 715
Cairns
Beekeepers 2
Hives 23
Townsville
Beekeepers 9
Hives 170
Cloncurry
Mackay
Beekeepers 14
Hives 47
NORTHERN TERRITORY
Winton
Rockhampton
Beekeepers 5
Hives 76
Nil
Beekeepers 75
Hives 1543
Blackall
Maryborough
Beekeepers 429
Hives 10,058
Charleville
Roma
Beekeepers 725
SOUTH
AUSTRALIA
Beekeepers 2
Hives 15
Beekeepers 4
Hives 166
Toowoomba
BRISBANE
Beekeepers 286
Hives 15,029
Hives 30,130
NEW SOUTH WALES

Plate 5

The Beekeeping Industry in Queensland, 1960. (Compiled from records in the Queensland Department of Agriculture and Stock and Commonwealth Census and Statistics Bureau.)

arms

A hive with frames of foundation is prepared orehand. When a swarm has clustered it is ken into an ordinary box fitted with a lid and en to the position the hive is to occupy. The me hive is then placed in position and a bag, th or paper spread out in front of the entrance provide a guideway into the hive. The swarm shaken from the holding box on to the guide-y. The bees will commence to crawl into hive and may be gently driven in by blowing little smoke on them. Avoid over-use of oke.

The swarm is less likely to leave the new hive a frame of unsealed brood is substituted for e of the frames of foundation.

Experienced beekeepers often shake the swarm ectly into an empty hive body (Plate 3) and ice an additional super of beecombs and a ver on top. A few days after the swarm has tled, the empty hive body is filled with bee-mbs.

ild Bees' Nests from Trees

In some localities wild bees' nests are plentiful d may be used as an inexpensive way of creasing stocks. These may be located by arching systematically for watering places; bees und watering should be sight-lined and followed their nest.

Before commencing operations, a standard ve with 10 empty frames is prepared; a lighted oker and a bucket of water are placed nearby assist in keeping tools and the hands of the erator free from honey. Additional tools and uipment required are an axe, a cross-cut saw, ood auger, hive tool, bee brush, sharp knife, ball of thin string, a small flat board and a gal. tin with the top removed.

The tree is felled and the position of the nest the trunk established by boring into the tree th a wood auger. Wax and honey on the tting spiral indicate the nest. The nest cavity is then exposed by cutting out a flitch of timber (Plate 4). Often the shock of the fall will disorganise the colony, making the transfer easier.

Smoke is blown gently over the exposed nest, the brood combs cut out and each piece laid flat on a board with an unwired frame placed loosely on top. With the knife the comb is cut to fit inside the frame and smaller pieces fitted to fill gaps. The comb is then tied with a few turns of string. If there is not sufficient brood to fill all frames in the hive, the remaining frames should be fitted with some of the honeycomb or with sheets of foundation.

Excess honeycomb and wax particles are placed in the 4 gal. honey tin, and later crushed and strained to obtain the honey. The wax is then melted.

When transferring, as many of the bees as possible are brushed or shaken into the frame hive which is then placed on or near the remaining bees in the nest. These bees are then smoked gently into the hive.

Movement of the bees is also facilitated by drumming with two sticks on the sides of the tree near the exposed nest. After a few raps the bees move, and by further drumming may be directed towards the hive entrance. The drumming should be regular and may require to be continued for about 10 min. The queen bee is transferred into a brood comb in the new hive. If the queen has been killed, the bees will draw queen cells, and another will hatch on about the sixteenth day. Alternatively, if a queen bee is available from a breeder, a new queen can be introduced immediately. At dusk the hive is closed with a piece of gauze tacked across the entrance, and removed to a permanent site.

In a few days the bees will have fastened the combs into the frames and the string can be removed.

This method, with appropriate modifications, can be used to transfer bees from box hives.

Oedema Disease of Pigs Spreading

Oedema disease of pigs appears to be becom-g more prevalent in south-eastern Queensland. eath rate of affected pigs is high and death ccurs suddenly.

Oedema in pigs is caused by an intestinal cterium or germ that secretes a poison.

Occasionally the eyelids, face or jowls may be swollen. The blood vessels in the tissues around the eyes may be very full. However, a weak, wobbly gait is often the only symptom observed. The temperature of affected pigs is variable, and either constipation or diarrhoea can occur.

—*S. G. KNOTT, Divisional Veterinary Officer.*

Sown Pastures To Stay On This 22 in. Rainfall Property

Experience with improved sown pastures on 22 in. rainfall country has led Messrs. F. W. and C. Lee, of "Coomoomie," Glenmorgan, to increase their plantings.

In eight years, their first, tentative, 10-acre planting of January 1954 has grown to 600 acres of buffel and green panic with the legumes lucerne and barrel medic.

The performance of these pastures on the reddish-brown belah soils has convinced Mr. Claude Lee they can double and probably treble the carrying capacity of existing native pastures.

The Lee family bought "Coomoomie," a raw, undeveloped 20,000 acres with no permanent water, in 1935.

Since then they have not only provided 120,000 cubic yards of water distributed over 30 paddocks, but in a pioneering venture of national importance they have proved their low rainfall country capable of producing winter and summer fodder crops and perennial improved pastures.

In this country where agriculture and pasture improvement depend largely on the skill of the landholder, their lead is being followed by others in the Glenmorgan and surrounding districts.

"Coomoomie" is mainly a sheep proper running a flock of Merino breeders and Corriedale stud. Some cattle are run to ke down roughage.

After the development stage—years of se shortages, bad seasons and the inevitable begi ners' mistakes—improved pastures are n making an impact on "Coomoomie's" fod production.

Mr. Claude Lee said paddock records indic that, even under a series of adverse seaso sown pastures have compared most favoura with annual grazing crops. Over the last t dry years, improved pastures have carried t sheep to the acre and held them in excelle condition. A well-managed 40-acre block Gayndah buffel, lucerne and barrel med carried three sheep to the acre for nine mont in 1960-61.

In addition, this block is expected to yield the region of 2,000 lb. of buffel grass seed th season. It yielded 1,700 lb. of seed of hi germination in the 1960 autumn. The 19 rainfall was 17 in.

Although rainfall is low, cultivation "Coomoomie" amounts to 2,200 acres. Cultiv tion first began in 1948 when a successful 9 acre oat crop was grown. Now winter crops wheat and oats total 1,200 acres and there a 400 acres for summer grazing crops, Sud

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This article was compiled from a report by R. G. Wilson, Adviser in Agriculture at Toowoomba.

Plate 1

Improved Pastures on "Coomoomie" (Glenmorgan District) Are Carrying an Average of 2 Sheep to the Acre in 22 in. Rainfall Country. This stand of green panic-lucerne-barrel medic is part of the 600 acres of improved pastures on "Coomoomie." This patch is growing on belah country—a brown clay loam.

ass and silage crops. Pastures are grown on 0 acres of well-prepared land.

Green panic has emerged clearly as the most latable grass, while buffel grass appears to and heavier stocking rates. Over the years, th grasses have withstood drought and heavy azing, especially the buffel grass.

Mr. Claude Lee's observations indicate that ter rain, sown pastures will provide good azing three weeks ahead of native pastures. here stock have access to both native and wn pastures, the animals spend 90 per cent. their time on the sown pasture—definite idence of its greater palatability.

Mr. Lee finds that the sown pastures are pecially valuable in maintaining the stud Corriele flock in top condition when annual crops are t available. The growth rate of young stock the sown pasture has been exceptional.

Plate 2

This is a Similar Pasture at an Earlier Stage of Establishment. The sowing rate is green panic 2 lb. an acre, lucerne 1 lb., and barrel medic ½ lb. With good management, it soon thickens into a dense stand.

The first 200 acres of improved pasture were sown on the brown belah soils. Last summer a further 400 acres of buffel grass and lucerne were sown on box, sandalwood, cypress pine and broadleaf ironbark soils. Plantings of green panic are restricted to the more fertile belah soils. Trial plantings of Biloela and American strains of buffel have been made to determine their value for this property.

Drawing on his long experience in growing improved pastures on relatively low rainfall country, Mr. Lee stresses these points for the guidance of the beginner: patience and persistence; and the need to make a start on a small fenced area. Like all the men who have succeeded in pasture improvement he has had his failures, too. But persistence brought its rewards.

Now, with an abundance of cheap, home-grown seed, he intends to expand his area under improved pastures as rapidly as possible.

Mr. Lee said he found the Agriculture Department's recommendations for establishing pastures stood the test of time. A well-prepared, fallowed seedbed, high-quality seed, shallow planting and sowing during the summer wet season, preferably February, he found, wen long way towards ensuring the success o planting.

He found that if the seed is of good qua with a germination exceeding 40 per cent., 2 an acre are adequate. This seeding rate may used for both green panic and buffel grass.

His final word is on pasture management:

In the first 12 months, always ensure that pasture seeds before stocking it, he said. T top cover provides protection against frost well as stand-over winter roughage.

As the soil here tends to "set" on the surfa annual renovation with a chisel plough beneficial to the pasture, especially when renovation is done in early spring, ahead of spring and summer rains.

Mr. Lee also places great reliance on provision of good watering facilities and adequate fodder conservation programme.

"It is safe to say that, in this country, improved pasture or annual grazing crop p gramme is entirely stable without good wateri facilities and fodder conservation," he said.

Home science teacher, Miss M. Green, of the Nambour State High School, gives a helping hand to young needlewoman, Hazel Herdemann, 16, a Junior-year student. The dressmaking class was one of the school's activities inspected by members of the 1961 R.N.A.-Shell Journalists' tour.

rchard and garden

Use Insecticides Correctly.—The use of ecticides in fruit and vegetable production ables growers to meet the demands of the reasingly quality conscious public by supplying oduce of high quality free from insects or insect mage.

In many crops the pests are persistent and the e of insecticides is an absolute necessity because thout them only a small proportion of the fruit d vegetables could be grown and few of these uld be worth harvesting for market.

Growers, however, should not be unconsciously l into thinking that more and more insecticides l further increase quality production. Some- nes a chain of undesirable or harmful results n follow unnecessary or excessive use of insecti- les or by using the wrong insecticides and erefore every grower before making an applica- n of any of these materials should first ask nself, "Is it necessary?" Then he should be re that he is using the *right* material at the *right* ength and at the *right* time intervals. Con- iced on these points he can proceed with con- ence that the result will be of benefit to himself d to all those dependent on him for fresh food.

—A. R. BRIMBLECOMBE, Senior Entomologist.

Marketing Vegetables.—Harvesting and cking are the primary steps in the distribution vegetables to consumers. Growers should be ry conscious of maturity when harvesting as is affects keeping qualities. Hence the neces- y for frequent pickings, as many vegetables ature progressively.

Producers must never loose sight of the fact at fresh vegetables are highly perishable and ery care must be taken to avoid bruising or ushing which often starts decay. Carriers and nsport operators are reminded that they are liged to handle growers' produce with the most care.

To ensure a ready market for their produce, owers should aim at uniformity in size, shape, colour and ripeness. This means produce should be carefully sorted, graded and honestly packed.

Growers could also consider the package presentation angle. Well-graded goods in clean, well-branded containers always command buyer interest.

The housewife is the final judge as to the real value of her vegetable purchases. So, as growers are anxious to maintain and improve vegetables sales, they should market their produce in such a condition as to ensure the housewife of clean, fresh, mature, well-graded vegetables at all times.

—C. M. APPS, Market Inspector.

Controlled Cropping in Bananas.—Top returns per acre from a banana plantation can be expected only when crop control is practised rigidly. Without control, bunches are thrown and mature irregularly during the year and a big proportion of the banana crop may have to be sold on summer markets glutted with other fruits.

The first stage of control is at planting. Experience and trial have shown that bananas planted from September to December will normally throw bunches about 15 months later—in February-March. This fruit is sold on a less competitive market between June and October.

The same plan for bunching and harvesting should be adopted—as far as practicable—for ratoon crops. This entails careful selection of follower suckers.

The selected follower should be a deep-seated sucker with a good corm and narrow sword-shaped leaves. Normally these suckers appear just before the parent plant throws a bunch and should be about 2 ft. tall in December. Followers set in December will produce bunches about 15 months later and provide a winter-spring harvest.

Set the right follower at the right time for the first ratoon, and subsequent setting will present little difficulty; the followers will be in the best position at the best period of the year.

—D. DOWDLES, Adviser in Horticulture.

IRONING RAYONS

Rayon fabrics are easily damaged when ironing, and for safety's sake follow instructions on the makers' tags.

If the tag is lost keep in mind that it is advisable to press rayon fabrics on the wrong side of the garment while it is still damp.

Those who do not own a modern, controlled-heat iron should remember that, as a general rule, only a cool iron should be used on rayon.

Acetate rayons can melt, be permanently marked, or glazed, when the iron is even warm.

Some rayons, however, can tolerate a moderately hot iron.

This group consists of washable rayon crepes, heavy dress weight and sheer spuns and lightweight lingerie rayons.

Before pressing the garment, make sure th the zipper is closed and that the iron is teste on the corner of an inside seam.

To avoid stretching the material, press th zipper area over a towel thickness.

MAKING COFFEE

Here are some methods of making a cup coffee at home.

For the 6 min. jug method you will need china jug or china coffee pot, medium groun coffee, cold water and a small wooden spoon.

First, boil the water, then scald the jug. Ne place the necessary amount of coffee (1 heape desertspoon to 1 breakfast cup of water) in th scalded jug, and pour the required amount boiling water over it.

Stir vigorously with the wooden spoon. Stan the jug in a basin or saucepan of hot water fo 5 min., and your coffee is made!

When pouring into cups, strain through a fin coffee strainer, and serve immediately.

Saucepan Method for After-dinner Coffee.— For this method you will need a small to mediu size saucepan with a tight-fitting lid, mediu ground coffee, and cold water.

Place measured quantities of coffee and wat in the saucepan. Place on heat, stir well a bring it to bubbling point but do not boil it.

Remove from heat, stir again, cover tightly a leave to stand on an asbestos mat over a ve low heat for five minutes.

Lastly, strain the coffee into a warmed chin coffee pot or pour directly into cups through coffee strainer and use at once.

Instant Coffee.—For this quick and eas method put 1-1½ teaspoons (or less, accordin to taste) of instant coffee into a cup, graduall pour boiling water over it and stir well.

Use the same proportion if making in a warme china coffee pot. Be sure to serve immediatel

Remember that sugar, cold or warmed mil and cream should be served separately an added to all coffee later, unless you are makin only enough coffee for yourself.

FIRST AID KIT

During summer, when people spend much of eir time outdoors, it is wise to be prepared r the discomfort of bites and scratches.

Picnickers should pack a small first-aid kit ith their picnic equipment, particularly if ccompanied by children.

Sand flies, mosquitoes, bull ants and ticks top e list for causing discomfort which prevents ll enjoyment of family outings.

The picnic first-aid kit should contain; a tube calomine ointment for bites; a small plastic ottle of diluted antiseptic solution for scratches nd cuts; one roll of elastic bandage for sprains; small needle container with two sterilized sharp eedles for splinters; a small plastic bottle of erosene and a pair af tweezers for ticks (keep ese two items wrapped together in a small astic bag to distinguish easily from the rest of st-aid equipment); a packet of band aids ifferent sizes); one roll of gauze bandage; a lastic bag of cotton wool balls; one pair of nall scissors with blunt points; a washer or a nall hand towel.

Place the first-aid equipment in a plastic box r plastic bag. Keep it together to prevent from ixing with food—particularly if packed in the ame picnic basket. Keep it handy and easily ccessible in case of need.

Remember that the picnic first-aid is only andy for minor injuries.

When going on a hike far removed from vilisation, be prepared for more serious injuries eforehand.

A careful study of a book on general first-aid ill help to remind of what needs to be done more serious emergencies such as snake bites nd falls involving fractures and dislocations.

Be prepared to allay discomfort. Know how cope with it, and family picnics will always e enjoyed.

RIMS ON CHILDREN'S CLOTHES

Busy mothers are fortunate these days in the ariety of flat trimmings available for children's lothing.

Here are some of the advantages, uses and ange of this type of decoration.

Flat trimmings save time and exasperation in that the iron runs over them—there's no need to slow down and take special care that the point of the iron does not damage the trimming or the article. They are easy to attach.

If the stitching comes undone there is less likelihood of damage to the trimming, and it is quickly and easily restitched.

Frills and lace on the other hand may tear before they can be restitched—and restitching is not always easy.

Little fingers can't pluck at flat trimmings and pull them loose.

Flat bows, stitched down, may not look quite so perky, but the loops can't catch and perhaps cause an acident, they can't come undone and look untidy, and they don't need retying.

The range in braids, cords and bias tapes has developed until now they are available in a variety of widths in plain colours, stripes, checks and spots, and in embroidered designs.

Owners of one of the latest sewing machines have, at the flip of a switch, a whole range of flat embroidery stitches that are attractive and quick and easy to apply.

Flat trims can be used—

- To hide the crease or colour line when a hem is let down (two or three strips will give a better effect).
- To outline neck and sleeve edges, and pocket tops and yokes.
- To tone or contrast colours, or both if more than one braid is used.
- To give the effect of yoke or panel, pinafore or apron front.
- To stitch down seams of gored skirts.
- To provide an effective trim by using a a wide and a narrow rick rack braid in combination with a straight braid.
- To stitch in rows around a full skirt towards the hem to emphasise fullness of the skirt, or to give a plain skirt character.
- To tone or contrast colours, or both if more than one braid is used.

—New South Wales Agriculture Department's "Press Notes".

Should I Give My Child Vitamins?

It is wise for mothers of all babies, be they breast fed or bottle fed to give their babies added vitamins until they are taking adult type meals. The time at which this occurs varies from child to child. Some children by the age of 15 months are having 3 full meals a day, while others are over 2 years of age before they are on this routine. Orange juice which is rich in vitamin C must be given during the early months as well as vitamin drops. If baby is unable to tolerate the juice from fresh oranges, bottled juice or rose hip syrup can be used as a substitute. The giving of vitamin C must not be neglected in babies even if the extra cost seems prohibitive. Lack of this vitamin can impare babies health and scurvy may result.

When the child is over a year old the mother may decide that he needs a "tonic" as well as his food and vitamin drops. Great care must be taken in selecting the type of "tonic" to ensure that the toddler is not receiving an overdose of vitamins. Most of the "tonics" suggested for infants are really only multi-vitamin preparations and the giving of them plus the vitamin drops is expensive and useless as well as being potentially dangerous. Children can suffer from an over supply of vitamins as well as from a deficiency. It is wise for the mother to consult her doctor before giving a "tonic" as her doctor is in a position to know the composition of the various "tonics" and will order one that is not already being given under another trade name.

In many cases when the child is pale, listles and off his food, an iron preparation is what necessary rather than vitamins. A blood test ca easily tell if this is an iron deficiency. When medicine containing iron is taken, it is essenti that the correct dose of iron be given. To small a dose is useless and only gives the paren a false sense of security.

Many mothers give their children an oi preparation rich in vitamin D during the earl winter months. This is to prevent rickets develop ing. In Queensland where the sun shines brightl during the winter, this is not absolutely essentia as the sun acts on the child's skin to form vitami D and so deficiency does not occur. In additio the oily taste of the preparation in our war climate may make the child nauseated. Of th "tonics" advertised to "build up the child resistance to winter ailments" vitamin C prepara tions are perhaps the most satisfactory—particu larly if the child dislikes fruit or vegetables.

To have a healthy child it is essential that yo give him the correct types of food. Nothing ca replace protein, fat, carbohydrates and vitamin found in food. A balanced diet is essential fo health, and strange as it may seem, children wit their seemingly unreasonable "wants" manage achieve a balanced diet.

Any further information on this and oth matters regarding children, may be obtained b communication personally with the Maternal an Child Welfare Bureau, 184 St. Paul's Terrace Brisbane, or by addressing letters to "Bab Clinic," Brisbane.

—*Queensland Health Education Council.*

PLOTTING FIRES ACCURATELY.—With more and more attention being paid to the organisation of successful fire-fighting in western Queensland, the following method of plotting fires accurately might be useful in districts in which this adjunct has not already become highly developed.

Requirements.—Prismatic compass, suitable map, Douglas protractor, pair dividers.

Steps

(1) Take a bearing with the compass on the smoke by day or the glow by night. Masses of metal will deviate the compass so it is preferable to get some distance away from them.

(2) Note the magnetic variation marked on the map for your area and correct the bearing obtained in (1) to obtain the true bearing. In western Queensland, variation is east, and the magnetic bearing is less than the true. To obtain the true bearing, therefore, the variation must therefore be ADDED on to the bearing read from the compass.

(3) Place the Douglas protractor on the map so tha the point from where the bearing was taken is under t small hole in the centre of the protractor, and so tha the horizontal lines and edges of the protractor a parallel to the latitude lines of the map. Line up th longitude lines similarly. Ensure that the red N is a the top. Mark off the corrected bearing with a d on the edge of the protractor. Using the edge of th instrument, join, with a light pencil line, the point fro where the bearing was taken to the dot.

(4) Obtain a second bearing from a neighbourin property, preferably not less than 20 miles away. Plo this on the map as in (3), and the junction of th two lines is the approximate position of the fire.

(5) With the dividers, and using the statute mile scale, find the distance separating the fire from the tw points.

With careful work, a fairly high degree of accurac could be obtained, particularly if a third bearing used, in which case the most probable position of th fire would be in the centre of the triangle formed b the junction of the bearing lines.— *J. R. M. WOLFE Extension Training and Research Officer.*

Producing Beef At Miles

K. F. HOWARD, Formerly
nior Adviser in Cattle Husbandry.

Plate 1: **The Calf is the Real Test of the Value of a Breeder.** This stud cow of ordinary conformation is a consistent producer of good calves.

Systems of cattle raising in the Miles and surrounding districts are described. Beef roduction is outlined according to carrying capacity, weight gains and total production, and omparisons are made between native pasture, improved pasture and grazing crops.

This article deals with an area that includes rtion of the western Darling Downs, the room-Wandoan area and portion of the aranoa. The shires concerned are those of ngil, Bendemere, Taroom, Murilla and inchilla.

From the town of Miles, the area stretches stward to Jandowae, west to Roma, north to miles north of Taroom and south to eandarra.

The western railway line runs from Dalby to yond Roma. There is a line from Miles to andoan and from Roma to Injune in the north. the south a line runs from Dalby to Glen- rgan. All-weather roads are on the increase.

Cattle production is the main activity, but er forms of primary production have been reasing as the country has been further veloped. With more property improvement ng made, sheep numbers have grown preciably.

Over the last 10 years, cultivation has extended rapidly and is making a noticeable impact on the district production. Winter and summer crops are grown for grain and grazing. Principal crops are wheat and oats in the winter, and the sorghums in the summer. Dairying is carried out on many of the smaller properties. Cultivation is undertaken mainly on brigalow but appreciable areas of box country and creek flats are also used.

The five shires of the area comprise approximately 2 per cent. of the total area of Queensland.

The importance of the area is gauged by the fact that 446,000 head of beef cattle were being depastured in the area at March, 1960. This number of cattle comprised nearly 8 per cent. of Queensland's beef cattle population. In addition to beef cattle, the area runs 3 per cent. of the State's dairy cattle and 7 per cent. of the sheep numbers.

In the 12-month period from March, 1958, to February, 1959, it is estimated that approximately 200,000 head of cattle were moved out of the area. At the railhead at Wandoan, 46,807 head of cattle were trucked in those 12 months. To this number have to be added the cattle that were walked out from that part of the area. Both stores and fats are produced. From the heavily productive area of Wandoan-Taroom, approximately 50 per cent. of the cattle that move out are fats.

A large proportion of the cattle that are sent out of the district as fats are bred within the area. Stores that are brought into the district come mainly from the north and north-west. Most of the data presented on rates of gain have been obtained by means of a mobile weighbridge. It should be recognised that these are average figures and may not necessarily apply to a particular property or situation.

Climate

The average annual rainfall at Miles is 25·6 in. The rainfall increases as one travels northward and eastward from Miles. It gradually decreases to the south and west.

TABLE 1

ANALYSIS OF WET AND DRY MONTHS AT MILES POST OFFICE IN THE 42 YEARS FROM 1917 TO 1958

Month	No. of years when more than 3 in. of rain fell in the month	No. of years when more than 4 in. of rain fell in the month	No. of years when less than 1 in. fell in the month
January ..	21	15	4
February ..	21	13	7
March	12	10	12
April	5	4	19
May	6	2	22
June	4	1	17
July	3	1	21
August ..	3	1	23
September ..	2	1	21
October ..	11	7	15
November ..	14	10	12
December ..	22	17	7

From the records of the past 42 years it can be said that December, January and February are usually the wettest months. The four driest months are usually June, July, August and September.

The area experiences extremes in summer and winter temperature. At Miles the average maximum temperature for January-February 91·5 deg. The average minimum temperatu in June-July is 39·6 deg. The January-Febru average maximum temperatures are higher th in Cooktown and Rockhampton. The avera minimum temperature for June-July is 4·7 d above that of Stanthorpe. Yuleba is sligh colder than Mitchell.

The lowest recorded annual rainfall at Mi is 14 in. This was recorded in 1957 follow a wet year of 46 in. which was the wettest record.

Vegetation and Soil Type

The biggest stretch of country that lends its to development is known as brigalow scr country. This varies considerably. In south of the area, it is more inclined to be with characteristic "melon-holes" appearing. T north of the area is somewhat undulating to hi

Brigalow (*Acacia harpophylla*) may grow its own or in association with a number of ferent tree species. It is often found in asso tion with belah, sandalwood, wilga, bauhin bottle-tree, and various trees referred to as so wood. Some scrubs may be almost or complet devoid of brigalow trees. The soils vary fr heavy black clay loam to chocolate loa Brigalow soils are generally of high fertility have the ability to retain moisture. This is essential quality for conserving the summer ra fall in order to grow crops in the winter.

Throughout the area the Great Dividing Ra runs from east to west. Forest country associa with the range comprises a great portion of area. The range country is characterised sandy soils of low fertility. Pastures on su country are frequently deficient in phosph though often they are deficient in nutrie generally. The topography varies, but the ra is not mountainous. Timbers include narr leaf ironbark, bull-oak, cypress pine, lancewo yellow jack, spotted gum, cabbage gum and wide variety of acacias. Ironbark, spotted g and cypress pine are milled commercially.

Throughout the whole area are found sm ranges and ridges similar to the Great Divid Range in fertility and vegetation. At the foot these ranges and ridges there is often excell country.

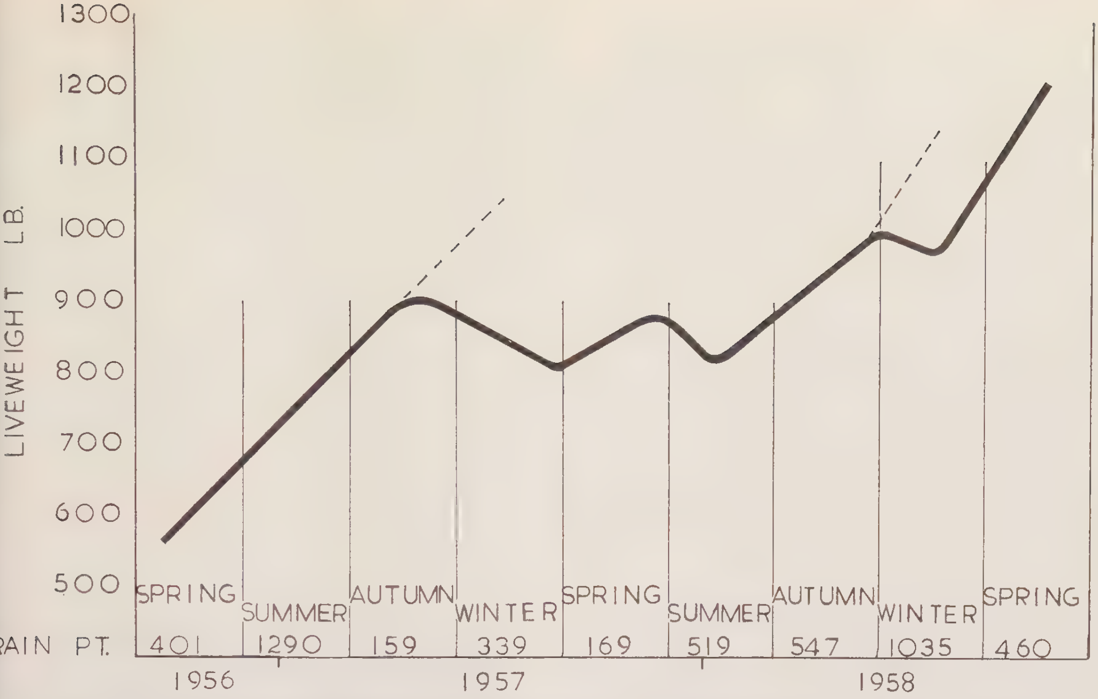

Plate 2: **The Growth Rate Patterns of Steers Born in August-September, 1955, and weaned in July, 1956.** The initial weight of 559 lb. was taken on September 25, 1956. They were sold as fats with an average liveweight of 1,218 lb. at just over 3 years of age. The average lifetime gain was 1.03 lb. daily. These steers grazed on brigalow-belah country which was well-fenced and well-watered. Drought in 1957 resulted in a depressed growth rate which was compensated for by very favourable winter conditions in 1958. The dotted lines show the gains which could have been obtained from oat grazing.

There are many creek and river flats which ow brigalow, coolibah, myall, apple tree, poplar x and silver-leaf ironbark. The soils of these s are generally fertile and respond well to tivation, when there is no danger of wash from ods.

The other principal type of country is that ich is mainly timbered with poplar box and ndalwood. Soils in association with these trees generally red to chocolate clay loams. They y in fertility and may provide good grazing, t generally are not so good as the brigalow ls. Some soils also grow myall, a fodder tree ich is commonly regarded as a sign of excellent zing country. The box soils are also used cultivation, but not to the same extent as the galow country.

The better class soils were heavily infested h prickly pear until the introduction of cacto- stis.

PASTURE AND CROP PRODUCTIVITY

(a) Native Pasture

Where brigalow has been ringbarked, steers grazing on native pasture have gained up to 3 lb. liveweight a day for 6 weeks or more. In spite of this, a well-grown steer on such pasture would not ordinarily average more than 1 lb. gain a day throughout life. A steer gaining at this rate would have a dressed carcass of 622 lb. at 36 months. Such a steer would have a liveweight of 1,175 lb. and a dressing percentage of 53 per cent. A birthweight of 80 lb. has been allowed.

A steer's weight gain will fluctuate between 1 and 3 lb. a day for a 2 to 6 month period in a normal year. As the average overall gain is only 1 lb. a day, it is obvious that there must be at least one period when gains are almost nil. Sometimes steers lose weight. The best gains are usually made between October and April. The growth rate of steers on native pasture is shown in Plate 2.

From May to October, poor gains can be expected. By April, the bulk of the pasture grasses are mature and are of less value than immature grass. Lack of soil moisture severely limits growth and when moisture is present, growing plants will be checked by frost in May or June.

Exceptions to poor cattle growth in late winter and early spring can be caused by good winter and spring rains. In heavy soil, winter rains will produce nutritious herbage growth. Moisture in the spring will produce highly nutritious grass growth when there are no frosts. Springtime usually means a feast or a famine as a dry spring is usually preceded by a dry winter.

On light soils, average daily gains might only be 50 to 75 per cent. of the gains of cattle that graze on heavy soils.

Apart from nutrition, growth rate can be reduced by wet boggy conditions, buffalo fly, foot rot and 3-day sickness. If uncontrolled, tick worry may be severe in the tick country which lies to the north of the Great Dividing Range.

Following the killing of timber on grazing country, ample and strategically placed fences and watering facilities are the main forms of improvement. Green brigalow scrub would carry a beast to about 30 to 40 acres. Once the timber is dead, brigalow country is amongst the State's best grazing land. The resultant native pasture will carry cattle at the rate of a beast to 8 acres whilst first class brigalow country when well used will carry about a beast to 6 acres.

Carrying capacity is a subject on which opinions vary widely. Difference of opinion often arises because one man may be more cautious than another. A property carrying to capacity is likely to fatten cattle even better than one that is understocked. Understocking can allow grass to become ranker and reach maturity quicker than if grazed evenly. The heavily stocked property is, of course, more open to the ravages of drought unless there are reserves of fodder.

Being selective grazers, cattle are prone to eat out some of the more palatable plants. This often allows less palatable and less nutritious grasses to replace the better grasses.

A well-subdivided property permits even grazing and allows spelling of paddocks. Some graziers object that cattle are set back wh changed from one paddock to another. So th may be if they are not moved often. But wh moved frequently, they will look forward to bei put into a new paddock. Dairyfarmers know h cows respond to a fresh paddock.

The few grasses that grow in green brigal scrub provide very little feed. There is a vari of scrubs including saltbushes that provide so grazing even in drought. The bottle tree is valu by many as a drought reserve. Various vi are also eaten by cattle in softwood and vi scrubs.

Where the brigalow scrubs have be destroyed, a variety of native grasses grow. The include various chlorises (star grasses), bl grasses, couch, button grasses and forest bl grass*—often called purple top—which provi the most useful feed.

With winter moisture, a variety of herba grows. Notable plants are burr medic (referr to locally as "trefoil" or "clover") and carr weed.

In poplar box and ironbark country many gra species are found similar to those in the brigal soils but often the grasses have more spin stalks and a smaller proportion of leaf to sta Where box, coolibah, appletree, silver-leaf ir bark and myall timbers grow (that is, on go soils such as creek and river flats) the timb treated country will produce feed as good as superior to the brigalow soils. Feed along wa frontage often deteriorates because of oversto ing near water points.

In the poorer forest country various wi and spear grasses make up the bulk of t grazing. Some areas contain stretches of spinif The main advantage of the light poorer soils that they will produce very quick feed after ra in the warmer weather. Grasses on such so mature quickly and so lose much of their fe value. Ridgy country can also be an advanta when the heavy soils are wet and boggy.

(b) Introduced Grasses

Rhodes grass (*Chloris gayana*) is the mo commonly grown introduced grass. It has be grown in the district for up to 50 years, and h made an appreciable contribution to beef pr duction.

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* *Bothriochloa intermedia.*

Plate 3

Freshly Ringbarked Brigalow Land in the Miles Area. In 1958, the cost of ringbarking this area was 30s. an acre.

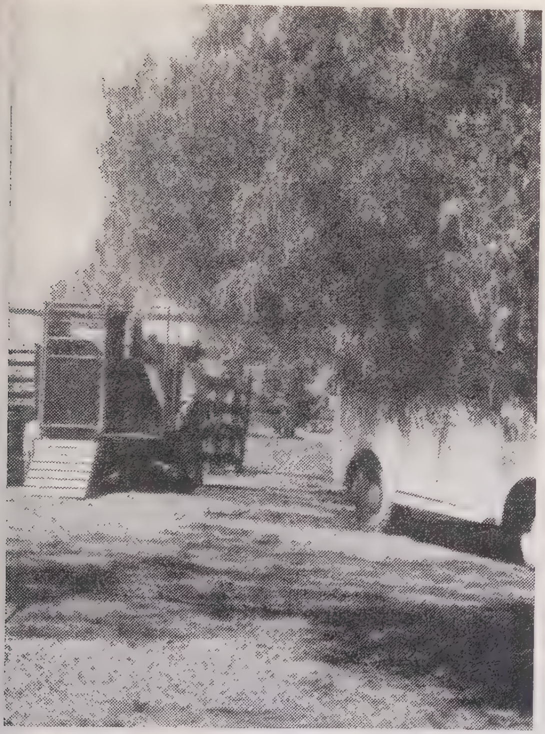


Plate 4

By Means of this Mobile Weighbridge, some 5,000 Individual Cattle Weights Were Recorded on a Wide Range of Properties over a Period of 3 years.

Plate 5

Store Steers from 18 to 20 Months Sold at Miles in November, 1958, for £23 each. At an approximate liveweight of 600 lb. this represents a rate of £3 16s. 8d. per 100 lb. liveweight. In 1957, similar steers cost £3 8s. 4d. per 100 lb. liveweight and by March, 1959, the price had risen to £4 13s. 4d. per 100 lb. liveweight.

Rhodes is commonly sown in ashes following the burning of brigalow scrub. It is superior to the native grasses in providing a greater bulk of feed which has a higher feed value for a longer period. Rhodes grass pasture will carry from 40 to 60 per cent. more stock than native pasture but its advantage can vary greatly according to management. It is frost susceptible.

In the 1957-58 drought, Rhodes grass provided better feed than grasses that were observed to be growing alongside it. Because it provided some green shoot, it was heavily grazed by stock. Much of it died and had to regenerate from seed.

Green Panic (*Panicum maximum* var. *trichoglume*) in the 1957-58 drought did not provide feed for as long a period as Rhodes but it survived the drought and provided very quick feed following rain. In warm breaks during the winter, it will provide quick feed in 4 or 5 days following rain. Green panic is a relatively new introduction to the area. It does not spread by runners as does Rhodes grass.

Buffel grass (*Cenchrus ciliaris*) and particularly Biloela buffel has shown its ability to provide quick feed in warm moist weather. The buffels are nutritious, but like green panic, they are comparatively recent introductions.

Many other grasses have been tried but they make no significant contribution to beef production in the area.

Lucerne (*Medicago sativa*) provided a small pick for cattle in the dry winter of 1957 and a group of steers gained weight and actually fattened when cattle on native pasture lost approximately 30 lb. Though only averaging ·92 lb. a day from the end of May to October this was sufficient to market them as fats. On one brigalow property in the wet year of 1956, lucerne plus grass produced an average daily gain of 1·4 lb. throughout the winter. Another group of steers in this same winter gained 1·9 lb. per day on a pasture that was predominantly lucerne. A mixture of lucerne and native grass plus some sorghum produced an average daily gain of 2·48 lb. per day from March to May in the Taroom area in 1958. At the end of the drought in 1957-58, lucerne was producing some green pick in areas where there was no other green feed available.

Lucerne has been grown and grazed on a wide variety of soils but it produces the greatest bulk of feed on creek flats where the roots get down to water. It has grown very well on brigalow and box soils.

The problem of bloat cannot be overlooked. Even though precautions are taken, it is still possible that bloat will occur. Some graziers have experienced no trouble. Others expect a loss of 1 to 2 per cent., whilst some individual losses have been higher. More than one grazier claims that the increased revenue from lucerne-grazing out-weighs the bloat losses. It has been remarked that more cattle die from the want of lucerne than from the eating of it!

(c) Winter Crop

Oats is undoubtedly the most common winter grazing crop. Barley, wheat, canary and rape are all used to an extent.

The highest gain recorded on oats was an average of 3·9 lb. a day for a group of dry cows that were fattened in 40 days. This was on a very good crop in 1958. In the same year some steers gained 3·7 lb. a day for 59 days. In the dry winter of 1957, a group of steers gained 2·5 lb a day for 56 days.

On a normal crop it is safe to reckon on a daily gain of 2 lb.

When oats is lush in the early stages of grazing, gains are not usually so high as when it contains more dry matter. When lush, a stand of grass or a late crop of sweet sorghum helps to cut down on scouring caused by young oats. Even so, some of the best gains recorded have been on oats where no other grazing was available apart from grass on the headlands.

Carrying capacity of oats will vary with the season. A conservative figure is a beast to 1 to 1½ acres. Often the situation is such that the crop will carry a beast to the acre for 6 to 8 weeks but will then take only a beast to 1½ or 2 acres for the remaining time. By September or October there is often a useful pick of green grass which forms a good balance with the maturing oats. Gains of cattle on dry oats in October can be as high as on green oats but rain will leach the nutrients from dry oats.

Leaf rust in wet years can reduce the palatability of oats. For best feed results the oats should be allowed to grow no more than 12 in. from ground level. In many areas, kangaroos and wallabies could easily account for 15 per cent. of the grazing.

Barley and grazing wheat are of considerable value when a late planting takes place. These crops do not usually yield so heavily as oats. Canary seed is a variable crop. It may provide only light grazing but in some moist years it has provided far more grazing than oats. Rape has carried cattle well. It is generally lush and palatable in the early stages. It can cause bloat. The gains for one lot of cattle which were weighed whilst grazing rape were not quite so great as those on oats. Rape is sometimes subject to attack by insects and pests.

(d) Summer Crops

Sweet sorghum, Sudan, Columbus grass, millet and cowpeas are the principal crops grown in summer. They have a useful but limited role in the grazing programme.

Weight gains of cattle on summer crop have varied from under 2 lb. to 4 lb. a day. While cattle in one trial were gaining 4 lb. a day, steers n native grass were gaining 3 lb. a day. From anuary to April, cattle may fatten as well on ood native grass as on crop. Summer crop can e useful in providing a quick growth of feed in he spring. Summer crop usually provides grazng when there is often good grazing available. he spelling of pasture paddocks and the suplementation of winter crops are uses that can e made of summer crop.

e) Late Summer Crop

A late crop of sweet sorghum is one of the ost useful crops for grazing. Such a crop lanted in February is grown on the summer ainfall but is ready for grazing in April. It can rovide good grazing from April to July. As ell as being a useful feed prior to topping off n oats, a late crop of sweet sorghum can provide n insurance against a poor oat crop, or an oat rop which cannot be grazed until more rain falls.

Sweet sorghum combines very well with lush ats and will help to counter scouring. In 1958, group of steers on one property was finished n sweet sorghum and went off as fats in June. n March and April they were on sweet Sudan ut grazing sweet sorghum in May and June nabled them to go off as fats when similar steers n grass were not finished.

In the dry year of 1957, sweet sorghum provided good feed when oats could not be fed until uly. From March to June a group of steers made an average gain of 1·8 lb. a day when attle on native pasture were losing weight from April onwards. On the same crop, two groups f weaners aged 7 and 10 months made steady ains when they were weaned directly on to crop. late crop of sweet sorghum differs from crops uch as Sudan and Columbus grass. These last wo plants have usually thinner and drier stalks in une whereas the sweet sorghum retains a juicy, alatable and nutritious stalk.

Grazing a late crop of sweet sorghum could make the difference between marketing steers as ats in June or waiting another 6 to 10 months.

BREEDS OF CATTLE

Herefords and Poll Herefords easily make up the majority of cattle numbers. The other major beef breeds are represented. Zebu and Santa Gertrudis have been introduced in recent years, but these are only in small numbers. Observation up to date indicates that they have a part to play in beef industry of this area. It would appear that when conditions are ideal (good grazing and absence of pests), there would be little difference in weight gains. It appears that adequate Indian blood will allow cattle to make superior gains in periods of inferior feed. This district, in common with most other areas, experiences such periods quite often. Temperament of Indian cattle must always be considered. They have been well-handled on big properties in other areas. Where British breeds cannot be mustered thoroughly the cattleman would not be advised to run Indian cattle. This, of course, may be a problem of stockmanship rather than a fault of the breed.

Though the district has a name for good quality cattle there is room for improvement within the recognised British breeds. This district imports more stud bulls from the Brisbane Exhibition sales than any other area. It would appear that there is greater scope for the stud breeder who is willing to select superior types that have proved themselves within the district rather than the continual reliance on southern blood. Selection for short-coated cattle is one way in which British breeds can be more suited to the area. Pigmented eyelids in Herefords is another factor which receives less attention than it should.

Those cattlemen who contemplate using Zebu blood would be advised to aim between ¼ and ½ Zebu blood in the herd.

Many cattlemen realise that the main emphasis in breeding must tie up with the money that the butcher will pay. Most breeders have an eye for conformation and Show points. The main factor in cattle prices is weight. Weight-for-age is inherited to a great degree. Some studs within the area are using scales so as to assess their best weight-gainers.

SIZES OF PROPERTIES

Most of the beef properties would vary from 2,000 to 15,000 acres in area. There are some properties which stretch over 100,000 acres. On properties under 2,000 acres a large proportion of improved pasture and/or cultivation is necessary for a reasonable living from beef cattle. This would be for the better type of country. On much of the range-type country properties are often 10,000 acres or more in order to provide a living area.

Ideas on the size of living areas vary. Some consider that a living area should support 400 breeding cattle (800 head altogether), whilst others consider as low as 150 breeders are sufficient. Often, of course, cattle are run in conjunction with some other form of primary production.

The carrying capacity of native pasture varies from 1 beast to 6 acres to 1 beast to 50 acres according to the type of country and state of development.

TYPES OF CATTLE PRODUCTION

(a) Breeding and Selling Weaners

The breeding and selling of weaners is probably the most common form of cattle raising in the area. It is practised on good and poor country but mainly on properties that are not suitable for breeding and fattening steers by 3 years of age. In a number of instances weaners are sent off good under-developed country that would be quite suitable for fattening if the timber were treated. The term "weaner" is used broadly but generally refers to store steers and heifers from 10 to 18 months old. Well-grown weaners, for the area, aged 12 months, would weigh about 500 lb. live-weight (approximately 250 lb. if dressed). They are generally on the market from October to April. Weaners are sold on the property or by auction at sale-yards. They may be purchased locally or bought by fatteners from other areas in south-eastern Queensland or from New South Wales. Many of the stores that go to New South Wales are walked. Because of the distance of the long trip, New South Wales buyers place little premium on forward condition in young steers.

The lighter country in the district would produce weaners closer to 350 or 400 lb. liveweight at 12 months. The average type of weaner sold in the district sale yards would be about 14 months with an average weight of 500 lb. Breeding and selling of weaners has several notable features.

There is no outlay required annually as with buying for fattening.

There is almost always some demand for weaners, which means that they are a reasonably certain source of income. They are suitable for light country which is not capable of producing fats.

The producer of weaners is generally hardes hit by a drought, as females that are in calf ar usually the first to die. When producing weaner on good country cull fat cows are often sold In a good season, vealers are sometime forwarded.

If a property is not overstocked, a low deman is not so serious as with older stock as the cattl are still relatively young in a year's time and ma return as much per acre.

Being prone to heavy drought losses, breedin properties are more in need of conserved fodde than fattening properties.

It is unfortunate that the standard of improve ment is generally lower on weaner properties Cultivation is commonly non-existent. A reserv of fodder could mean that the property coul carry to capacity and remain safe during drought.

With beef at £6 per 100 lb. dressed weight, 14-month store steer weighing 500 lb. liveweigh is worth about £17. Heifers would be about £1 but are inclined to fluctuate more than steers The approximate cost of selling these weaner would be 16s. a head.

(b) Breeding and Selling 2-Year-Old Stores

With normal store prices, there appears to b little difference in the economics of producin store weaners or 2-year-olds. The price pe month of the steer is, of course, less but it i sometimes overlooked that only one breeder ha to be run for 2 steers, whereas one breeder i required for each sale animal when weaners ar sold. Actually slightly more than one breede is required per calf because calving percentage are always less than 100. This means that wit weaner production there are more breeders tha are not earning their keep in relation to th number of steers on the property. When steer are sold as 2-year-olds, the heifer portion is stil generally sold at weaner age.

An average 2-year-old steer in the saleyard would have a liveweight of about 700 lb. Some good quality steers running on good country would be closer to 900 lb.

With beef at £6 a 100 lb. dressed weight, 2-year-old steer weighing 700 lb. would be worth about £23.

The price of stores on a liveweight basis is about £3 8s. a 100 lb. for 12-month-old steers and £3 5s. for 2-year-olds.

Three-year-old stores are less common but ually come from the properties that are larger area and not mustered so cleanly. At these tes, a 3-year-old store is likely to weigh about 0 lb. and sell for £24 or £25.

It is usually an uneconomic proposition to sell year-old stores instead of 2-year-olds. They ake good buying because they will usually tten quicker than younger cattle.

The boom store market of early 1959 caused ices of up to £4 10s. a 100 lb. liveweight to paid for store steers. This would mean that 500 lb. steer at 12 months old would be worth out £22 or £23.

) Breeding and Fattening

Breeding and fattening is a self-contained stem. The cattleman is not exposed to market ctuations to the same extent as the buyer and tener. Breeding and fattening is commonly actised on the better type country. Off grass, steers are generally sold when 3 to 4 years th an average age of 3½ years. Heifers are en sold as weaners but sometimes are fattened d sold from 12 months to 2 years. In good asons, vealers may be sold about 10 months th a dressed weight about 300 lb. Relying grass to fatten sometimes means that 3-year-l steers have to be sold as stores in a dry time kept for another year to be fattened. In the ter case more country per beast must be allowed undue risks are to be avoided.

METHODS OF PRODUCTION

Breeding and Fattening on Native and Improved Pasture Plus Crop

Breeding and fattening properties generally d themselves well to intensive development by use of improved pasture and/or cultivation. e combination of native pasture, improved ture and crop can increase carrying capacity atly. In addition, it is possible to turn off ear-old steers with dressed weights from 600 630 lb. The use of improved grazing allows:

1. Higher average weight gains of cattle.
2. Higher carrying capacity of property.
3. Turning off of cattle from July to December when the supply of fats is usually lightest.

These three factors combine to make improved zing an economic proposition.

This system usually has meant that steers are carried on native pasture up to 20 months of age and topped off on oats from June to the end of September. Such steers would probably dress from 520 to 550 lb.

A further development is to wean the steers on to crop in July. These steers would then be forward to fat by the time they went on to winter crop the next year.

Two-year-old steers weaned on to crop and fattened the following year on winter crop have dressed 630 lb. in the district.

Weaning on to crop means that the steers are generally fat at 12 months of age. Such stock would provide excellent beef for the domestic market but are too light for export. One advantage of weaning on to crop is that the cattle are almost always fat so that advantage can be taken of a price rise. Some dairy farmers have been doing very well by raising A.I.S. crossed with a beef bull. Weaned on to lucerne or crop, such calves will dress from 350 to 400 lb. at 12 months.

A weaner could be weaned on to ½ an acre of oats in July, plus ½ an acre of lucerne and 1 acre of native pasture or Rhodes grass. In their second year, these steers would have 2 acres of native pasture, 1 acre of lucerne, ½ an acre of sweet sorhgum and 1½ acres of oats. This feed should also provide a month or so of grazing from the breeding cows.

Quite often a surplus of winter feed would allow purchase of stores that may be turned off after 8 weeks of fattening.

(b) Buying and Fattening on Grass

When fattening on native grass or Rhodes grass, the cattle are generally turned off as fats within 12 months of buying. Age of turn-off varies from 3 to 4 years with dressed weights from 550 to 700 lb. Odd mobs are older than 4 years. Fattening usually calls for a fine sense of market values as a difference of £1 or £2 per head could vary profits by 20 per cent. With beef bringing £6 per 100 lb., good grass feed should add £8 to £10 net to the value of a steer in 12 months. If a 2½-year-old steer is landed on the property at a liveweight of 800 lb., costing £26, he should have a liveweight of 1,160 lb. in 10 to 12 months' time with a dressed weight of about 600 lb. At £6 per 100 lb. this steer would be worth £36. Approximate selling costs at £3 10s. bring the steer to a net value of £32 10s., giving a net return of £6 10s. for the 12 months. If the country is rated at say a steer to 8 ac. it will probably carry a beast to 7 ac. The reason for this is that the cattle will generally be turned off in 10 months, leaving the paddocks to spell for 2 months. Though no calf branding is required with this system, the most successful fatteners are constantly observing their cattle and moving fattening cattle into the finishing-off paddock. Apart from carrying more stock to the given area the use of Rhodes, panic or buffel grasses permits cattle to be fattened faster in comparison with native pasture. The fattener usually needs to spend more time than others at cattle sales and inspecting paddock cattle in order to get the type of cattle he wants when he has good grass available.

Light country is often used to fatten heifers. Speying is advisable to prevent the heifers from getting in calf. Though heifers are not likely to make better gains than steers they have the ability to put on an outside layer of fat. This means that they can be fat whilst steers are still in store condition.

(c) Buying and Fattening on Crop

The system of buying and fattening on crop may incorporate a mixture of crop and pasture or be confined to crop only. The most common feed is oats, which is grazed from June to the end of October. The season will sometimes start in late May and can continue through to late November. In a normal year there usually will be 3 months' grazing when 1 ac. to 1½ ac. is required for each steer. It is then usually necessary to decrease this stocking rate. In drought years, the useful grazing may be reduced to about a 2 months' period.

Heifers are commonly fattened but should not be heavy in calf as they may calve before they reach marketable condition. Dry cows will make good gains but the disadvantage is that on a normal market, the cow is putting on beef worth £5 10s. a 100 lb. whereas the steer beef is worth £6 10s.

From a fattening viewpoint, cows and calves are not usually so profitable as steers or heifers. When cows and calves are fattening on oats, the cows are likely to be gaining 1 lb. liveweight a day whereas their calves will gain approximately 2½ lb. a day. A cow and calf could be replace by 3 weaned 8-month-old calves which woul gain 2 lb. a day each. The carcass beef that th calves would gain would be worth £7 a 100 lb when the cow beef on the same market is no likely to be worth much more than £5 10s.

CROP FATTENING

When weaning calves on to crop, care shoul be taken to see that the weaners settle dow quickly. Two methods can be used. One wa is to see that there are other quiet cattle in the oa paddock which will provide steady company fo the weaners. Another worthwhile method is t use a creep so that calves can walk throug restricted openings to the oats whilst their mother are left in the grass paddock that joins the oats

When steers are fattened on oats they ar usually 2 to 2½ years of age. Their period fo topping off is usually from 8 to 12 weeks, depend ing on the state of the crop and the conditio of the cattle when going on.

If crop only is used for fattening, the disad vantage is that suitable cattle must be availab at the right price at the right time. This is no always possible. Sometimes pasture is use simultaneously with the oats. It is most usef when the oats is very lush at the beginning of t grazing period. Pasture can also provide usef feed in a good spring. When the oats is dryi off, the combination of green pasture and oa will produce good gains.

The crop fattener may buy 2-year-old stee in December weighing about 700 lb. Such stee would cost about £23. They would make fa gains until April but May and part of June a likely to be periods of little or no gain. Th would then go on to oats in June at a liveweig of about 950 lb. They should top off, after weeks on oats at 2 lb. a day gain, weighi 1,090 lb. liveweight. With a dressing percenta of 53 they would dress 578 lb. in August. The would probably be sufficient feed left to fini another mob that would have been more or le "coasting" on the native pasture. In this wa two and sometimes three groups may be turn off a winter crop in one season. The avera rate of gain can be improved by providing goo feed during April, May and June.

The crop that seems best equipped for th role is sweet sorghum. A sweet sorghum cr hat is planted in February will generally become rosted before reaching full maturity in May. uch a crop is capable of fattening cattle when he grass has lost its fattening qualities. Often n May the oats appears to be ready for use, but as insufficient root-hold to stand grazing. If uying stores from October to December, 3½ ac. f grass, ½ an ac. of sweet sorghum and 1¼ ac. f oats would be sufficient to top off 2 or maybe steers. Sweet sorghum provides excellent oughage when the oats is ready to graze.

With further development it is likely that there vill be a trend towards the fattening of younger attle. This will hinge mainly on their having nade superior gains earlier in life. With the ontinuous high plane of nutrition, it is possible turn off 2-year-old steers in September-ctober with dressed weights of about 620 lb. uch steers would be required to be weaned on oats when about 8 months old. Fattening on ats permits a large proportion of fats to be narketed from September to November when rices are usually higher than at other periods f the year.

Heifers and cows fatten well but are a rather oubtful proposition. Often when they have had everal weeks of feed, they will calve and so pset the marketing programme. Females should ot be put on crop unless it is certain that they an be marketed before calving. Such informa- on is rarely obtainable—particularly with bought eifers.

STOCKING RATE

Stocking oats at the correct rate requires xperience. It will depend on the growth of the ats, the moisture content of the soil, the pos- bility of receiving rain when stocked and the ngth of the fattening period. A crop with plenty f growth might well fatten more than a beast the acre in the short term but it is unlikely carry more than 1·5 head to the acre for months. Normally, a crop about 1 ft. high ielding about 4 to 6 tons of green feed to the cre will carry at the rate of 1:1. (Yield of crop er acre is found by weighing the edible growth f 2 sq. yd. A weight of 4 lb. from 2 sq. yd. roughly equivalent to 4 tons per acre.) Ideally ne oats should be kept grazed within about 6 in. f ground level. The crop should never be llowed to get over 1 ft. in height. Normally it is better to start with slightly fewer cattle than required and build up numbers when it can be seen that the crop will stand slightly heavier stocking. Oats can be regarded as largely wasted if it is fed to a steer for a few weeks and he then is returned to dry grass. The only time when such waste is justified is when a heavy grazing is necessary to avoid or reduce rank growth. When the crop is seen to be doing well, the fattener will often purchase further stores to put straight on the crop.

Wet weather and boggy conditions can be inconvenient when grazing oats. Opinions vary as to whether the cattle should be moved from the cultivation in such periods. If the cattle are left on, the trampling can be harmful to the crop and cause difficulty when next ploughing. When stores are brought on to a property for fattening on oats, it is best if they can settle on grass for a few days before going on the crop. When fattening, contentment of cattle is of primary importance.

GROWING STOCK

Keeping growing stock is not a common practice in the district but sometimes it is carried out unintentionally. Sometimes a grass fattener may not fatten his steers by winter time as he had intended. In such a case, he will often sell them as stores. In a normal winter, these steers would be welcomed by the crop fattener. Such steers are usually very forward and may be turned off within 8 weeks of grazing on oats.

DISEASES AND PESTS

The main stock diseases in the area are caused by ticks. Apart from the direct effect on cattle, ticks are of economic importance as they may cause a delay in moving the cattle from ticky country, to or through a clean area. This naturally can affect price. Before being moved from a tick area, cattle must be free of ticks. They are then given a final dipping and moved. Various tickicides are used but paddock management and strategic dippings are proving effective within the ticky areas. Spelling of paddocks and repeated dippings early in the spring months have been carried out successfully by a number of graziers. The most commonly used tickicides are arsenic and DDT. Plunge dips are the most common but the use of the spraying technique is increasing.

Broadly speaking, the country on the northern or coastal side of the Dividing Range is ticky while the southern side is clean.

Calves are commonly vaccinated for blackleg at branding time.

A number of properties are in the habit of drenching weaners to control worms. The men that drench claim good results. Drenching should go hand in hand with turning weaners into a spelled paddock.

Occasionally cattle are sprayed for lice. Lousy cattle are generally those that are suffering the effect of a low nutritional plane.

Some properties have T.B. infection through their cattle herds. Testing and slaughtering of suspected animals is an economic proposition from the point of view of the owner and the industry in general.

There are periodic spasms of seasonal complaints such as foot-rot, 3-day sickness and buffalo fly. These occur only occasionally. The calving percentages of some herds would suggest that there could be infertility in places.

MINERAL DEFICIENCY

There is undoubtedly a phosphorus deficiency in much of the range-type country. This can be counteracted by feeding bonemeal as a lick. A common mixture is 50 parts bonemeal and 50 parts salt. In most cases, supplementation of concentrated liquids in water supplies is not suitable. This method requires that cattle drink from a trough to get their ration of phosphate. Most of the range-type country has surface water for which fencing-off would be impracticable. Whilst range country is low in phosphate, it is generally low in other plant nutrients and moisture. The combined shortage of plant food leads to a general nutritional deficiency rather than of phosphate only.

HORSES

There is scarcely a general pattern in the breeding of suitable stock horses. Often mares that are not suitable stock horses are turned in with the stallion and used in the hope of breeding better ones. Stallions are mostly thoroughbreds or near thoroughbreds but there are some Arabs. All of these can breed good stock horses. There is general agreement that many horses are too leggy. Within thoroughbreds there is a thick-set type that could well be concentrated on. A little draught blood such as Percheron or Suffolk Punch can be an asset.

ACKNOWLEDGMENT

It is desired to acknowledge the co-operation of numerous graziers in the area who helped to provide answers on many aspects of beef pro- duction. Of special help were those who co-operated in cattle weight trials in particular Mr. W. D. S. Harpham who co-operated in regular monthly weighing programme carried out on his property for several years.

New Milk Product

DAIRYMEN HOPE that butterfat spread the new product developed by Agricultur and Stock Department scientists will giv them a bigger share of local and overseas markets. Butterfat spread can be used as a cake mix as well as a cake frostin and filling, as a flavoured drink, and as a con- densed milk. Mr. G. G. Crittall, Chemist, an Miss Patricia Loane, Dairy Technologist, chec the temperature of butterfat spread in the labora- tory. Work is under the direction of Mr. L. E Nichols, the Department's Director of Dair Research.

lephant Grass—
Standing Fodder Reserve

A. HUTCHINGS, Senior Adviser In Cattle Husbandry.

On Mr. and Mrs. C. Lemon's mixed farm at unt Cotton, in south-eastern Queensland, a em of herd feeding based on pastures and os plus elephant grass is planned. Hand ling of stock is not practised. The aim is to elephant grass, in part, as a standing fodder rve.

Although many farms are more highly eloped, the production achieved during last r's drought suggests that much progress is being le. Total milk production and rainfall for past 6 years are shown in Table 1:

TABLE 1

Year	1955	1956	1957	1958	1959	1960
fall (in.)	55·3	59·8	24·8	44·7	53	24·3
(gal.) ..	6,093	9,600	4,667	5,663	6,354	10,070

There is an interesting comparison between the rs 1957 and 1960, because, in both, less than n. of rain were recorded. Yet production for 0 was over twice that for 1957.

The property was purchased in 1953. Soils e been classed as poor scrub loams and podsol, rlying shale and clay. Topsoil varies in depth n 6 to 12 in. Much of the property consists of steep slopes. However, the lower slopes have been cleared of eucalypt, lantana and wattle regrowth and are being sown to improved pasture.

In 1957, a demonstration was commenced on this property using funds made available from the Commonwealth Dairy Industry Extension Grant.

Kikuyu and elephant grass were established in a number of small paddocks which were fenced to suit the irregular contours of the land. Plantings commenced in September, 1957, and in the following month and during subsequent years, additional areas have been planted. At present 7 acres are planted to elephant grass, while 15 acres are grassed with kikuyu.

Preparation

Land was pre-cropped with millet and Poona cowpeas for summer grazing, and oats and red clover for winter grazing. Elephant grass crowns were planted in rows 4 ft. 6 in. apart, with 2 ft. spacings along the row.

A mixture of lucerne and white clover was sown at the rate of 1 lb. to the acre. The clover has grown fairly well and provides some winter and spring feed. Lucerne has shown poor growth on this property.

A small trial is now in progress on the suitability of tropical legumes such as glycine, stylo, desmodium and centro in combination with elephant grass as a permanent pasture.

At planting time, blood, bone and super fertilizers at 6 cwt. to the acre together with some fowl manure, were spread along and near the rows.

Subsequent yearly dressings of 1 to 3 cwt. of 5:13:5 fertilizer together with all available pig manure have been spread along the rows. Fertilizer is always applied when it is raining or about to rain.

Grazing and Mowing

The elephant grass was allowed to become properly established before grazing commenced, after which grazing has been controlled at intervals of 3 weeks by using an electric fence. By regulating the length of grazing time the grass is eaten down to approximately 1 ft. from the ground and excessive grazing is avoided.

Excess summer growth is reduced to a height of 12 in. with a rugged homemade rotary slasher. This chopped material forms a mulch for retention of moisture and protection from the hot sun. Inter-row cultivation is important until the crowns of elephant grass spread between the rows.

Irrigation

The average annual rainfall at Mount Cotton is 45 in. with the usual dry winter and spring months. The need for supplementary irrigation during these dry periods was realised, and preparations for water harvesting were completed. Catchment areas on this property are small but Mr. Lemon has built six dams with his tractor and scoop. Advantage has been taken of the dry spells to enlarge the dams, which now have a total estimated capacity of 5 m. gal.

A portable spray plant is taken from dam to dam for irrigating the several small paddocks. With the limited catchment areas, the available water is reserved to keep pastures alive rather than promote continued lush growth.

Production last year from a mixed herd was nearly 500 gal. per cow. Mr. Lemon envisages higher production and greater carrying capacity as further areas of his property are improved.

Plate 1: **The Herd Grazing Row-Planted Eleph Grass.**

Plate 2: **The Electric Fence Prevents Waste Permits Quick Regrowth.**

ucket and bail

Telescopic Gate.—A telescopic cow-yard gate
cribed in the *New Zealand Dairy Exporter* has
ot to commend it. The gate is constructed of
-and-a-half-inch galvanised piping and the
ing fence into which it slides is of 2 in. gauge.
ese are the minimum gauges for a gate which
l withstand pressure and buffeting without
ger of bending. When closed, the gate fills
opening 10 ft. 6 in. wide, but is actually
ft. 6 in. wide, the extra foot which remains in
holding rails being necessary to provide
bility.

A cast iron wheel from an old mower, or of
type used for children's trolleys, provides for
ooth and effortless opening and shutting. Two
all pieces of steel fitted on each side of the wall
which the gate closes increase its strength
en closed.

Clean Skim-Milk Lines.—The skim-milk pipe-
to the piggery should be flushed at least once
ay to prevent a build-up of milk residues.

The easiest way is to flush the pipe with warm
ter and then fill it with warm water containing
f a pint of molasses. The molasses solution
l prevent a build-up of curd if left in the pipe
ween milkings.

This has proved valuable in cleaning factory
termilk pipelines.

—*W. D. MITCHELL, Dairy Technologist.*

Thermostats on Dairy Boilers.—Thermostats have two temperature settings called "cut-out temperature" and "cut-in temperature," meaning "switch off" and "switch on" temperature respectively. Normally the cut-out temperature is set by the operator, and is the maximum temperature to which the water can be heated. Some thermostats are made so that the two temperatures are close, say half a degree apart, for example, cut out 180 deg. F., cut in 179·5 deg. Special points and costly manufacture are necessary for instruments as finely adjusted as this. Commercial water heaters usually have a range of about 10 deg., that is, cut out 180 deg., cut in 170 deg.

In the dairy it is necessary to have water heaters fitted with an additional special high range thermostat, so that the heater can boil the water when the "boiling switch" is closed during the hour or so taken for milking. It is possible, in a heater with the normal thermostat, set at 180 deg., to close the boiling switch when the water is only just above 170 deg. If, however, the thermostat is set at a lower temperature than 180 deg., it is likely that the heater will not have time to boil before the milking is completed. This means that for effective use of the special boiling switch, the ordinary thermostat must be adjusted to 180 deg. at least, and keep in good repair.

—*J. D. ELRINGTON, Senior Dairy Adviser.*

New Machine Aids Harvesting Of Cowpeas

Plate 1: **A Summer Crop of Malabar Cowpe**

By N. H. ADAMS,
Senior Adviser In Agriculture.

A machine invented by a Maidavale farmer for the purpose of overcoming the difficultie of harvesting cowpea seed, cuts the intertwined crop at ground level and windrows it read for mechanical seed harvesting.

The timeliness of a machine to assist cowpea harvesting is shown by these factors:

(1) There is a constant and growing demand by farmers and graziers for cowpea seed.

(2) The Burdekin district with its dry warm climate and available irrigation water is well suited to crop seed production.

(3) Stem-rot resistant cowpeas are the latest addition to the list of seed crops in commercial production on the Burdekin.

The cowpea is a summer crop, and normally develops a mass of interlocking vines and foliage forming a complete field cover. While this feature is desirable in a green manure cover crop, it creates quite a harvesting problem for the seed producer.

The problem may be overcome by planting at the end of summer, so that the crop is grown through the autumn and early winter.

Under cool weather conditions, vegetati
growth is restricted and rows will remain distin
when planted 4 ft. apart. The crop may th
be conveniently cut and left in windrows to d
before threshing. A mower may be used f
this purpose, but most growers prefer to u
knives attached to the tractor cultivator feet a
set at an angle of about 45 deg.

The autumn crop offers a solution to t
problem of excessive vegetative growth, but the
are disadvantages also. Planting time is restricte
and land preparation and bare fallowing ta
place in the summer rainy season. This is n
good farming practice, particularly in tropic
areas

Cowpeas planted in late December will gi
a good cover over most of the wet season. T
seed will be ready for harvest some 4 to 5 mont
later, well after the wet season period. Irrig
tion is not normally necessary for this cro

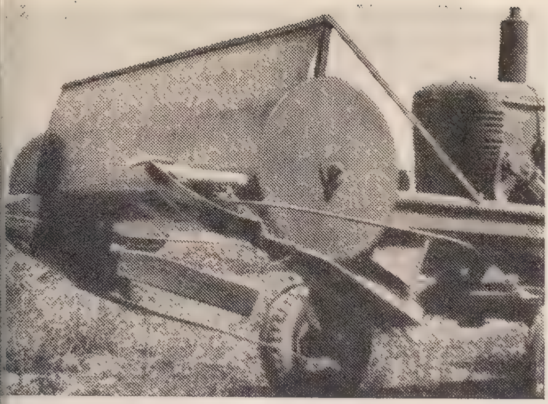


Plate 2: **Front View of the "Legume Vine Cutter-Windrower".**

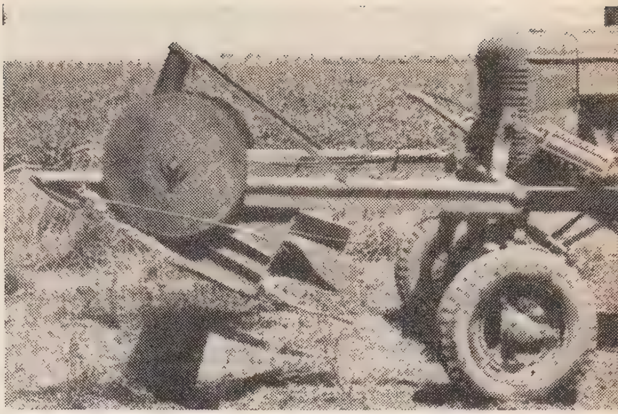


Plate 3: **Side View of the "Legume Vine Cutter-Windrower".**

which means cheaper production. Cowpeas will also thrive with the aid of irrigation when grown through the spring months. In both cases the seed producer must contend with excessive vine and foliage growth.

Mr. Keith Whitson, of Maidavale, Ayr, has given a lead in the production of seed from legume vine crops. He has designed and constructed a machine which is being patented under the name of "Legume Vine Cutter-Windrower". This machine is designed to cut an intertwined vine crop at ground level and in the same operation place it in windrows ready for mechanical seed harvesting. For the efficient operation of this machine the crop must be planted in rows which should be slightly hilled.

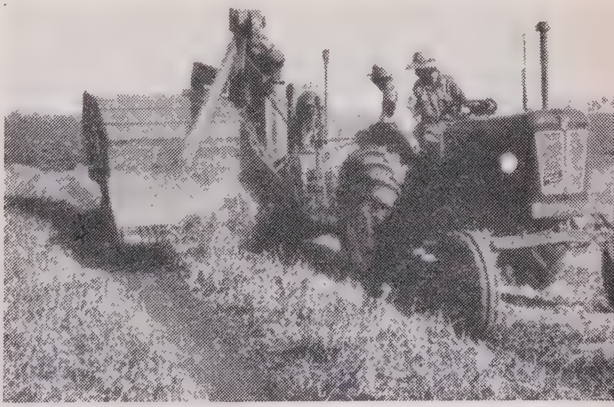
Special Features

The cutter-windrower is mounted on an iron frame which is attached to the front of the tractor. The frame of the prototype machine is ft. in length and 5 ft. in width. It is hydraulically operated and can be raised for transport.

A 2 ft. diameter circular saw has been mounted on each side of the forward section of the frame in a vertical position. The two saws are connected on a 1 in. diameter shaft, which is driven in a forward direction by a Vee belt and pulley from the tractor. The saws cut the vines vertically. The forward section of the frame enters the crop, and two downward pointed prongs lift the vines free of the ground surface and onto the rotating saws.

Plate 4: **Dense Malabar Cowpea Crop** Cut and Windrowed by Mr. K. Whitson's Machine.

Plate 5: **Harvesting Malabar Cowpeas** which Yielded 25 Bushels per Acre.



The plants are cut horizontally at ground level by two knives attached to the frame and set at 45 deg. Each knife is 3 ft. long and 3 in. wide. They develop a cutting action as the machine moves forward. Two swathe boards are placed above the knives for the purpose of windrowing the crop.

A buffer shield of heavy gauge galvanised iron 2 ft. 6 in. in height is fitted across the front section of the machine immediately behind the lifting prongs. The purpose of the shield is to prevent the crop becoming entangled in the machine and front of the tractor.

The addition of saw guards would protect th machine from accidental harm from flying stick or other material which might find its way into a crop.

Other Uses

The present design of the "Legume Vine Cutter Windrower" restricts its use to annual crops It is now being redesigned, so that it will handl perennial sward crops. The scope of the machin will then be expanded to include the harvestin of pasture legume seed.

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Tuberculosis-Free Cattle Herds

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Aberdeen Angus

ridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
rothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

ox, T. L. & L. M. J., Seafield Farm, Wallumbilla
rookey, J., Arolla A.I.S. Stud, Fairview, Allora
avis, W. D., "Wamba", Chinchilla
ennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
dwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
vans, E. G., Lauraven A.I.S. Stud, Maleny
reen, D. B., Deloraine A.I.S. Stud, Fairdale, via Wondai
eading, C. A., "Wilga Plains", Maleny
enry, Mrs. K., & Sons, P.O. Box 4, Cambooya
enschell, W., "Yarranvale", Yarranlea
. M. State Farm, Numinbah
ittleton, H. V., "Wongalea". Bowenville
arquardt, A. C. & C. R., "Cedar Valley", Wondai
cShane, A. H., Handford Road, Zillmere
ears, G. S. & E., "Morden", M. S. 755, Toogoolawah
oore, S. R., "Sunnyside", West Wooroolin, via Kingaroy
eale, D. G., "Groveley", Greenmount
'Sullivan, Con., "Navillus", Greenmount
'Sullivan, P. W., "Navleigh", MS 371, Greenmount
illips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H., "Sunlit Farm," Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

udgeon, Est. C. E. R., Marionville, Ayrshire Stud, Bald Knob, Landsborough
unn, T. F., "Alanbank", Gleneagle
vans, E. R., Stimpsons Pty. Ltd., Loganlea
oddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L. "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Office, Gympie

Friesian

ehrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
acdonald, S. E. G., Conondale Rd., Maleny
orrison, E. J., Cedar Creek, via Closeburn
aumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah
Superintendent, Marsden Home for Boys, Station Rd., Nth. Booval

Guernsey

oss, W. H., Degilbo, via Biggenden
etcher, A. B., "Cossart Vale", Boonah
olmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
hnson, G. L., "Old Cannindah", Monto
iller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton
Wilson, J. R., "Okeden", Proston

Jersey

eckingham, C., Trout's Rd., Everton Park
irt, W. C. M., Pine Hill Jersey Stud, Gundiah
orchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
urrows, R. N., Box 23, Wondai
ygrave, P. J. L., Craigan Jersey Stud, Aspley, Brisbane
arpenter, J. W., Flagstone Ck., Helidon
onochie, I. S., "Brooklands" Jersey Stud, Sherwood Rd., Sherwood
rawford, R. J., Inverlaw, Kingaroy
arm Home For Boys, Westbrook
owler, P. & Sons, "Northlea", Coalstoun Lakes
rench, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
arley, G. W. & P., "Hopewell", East Nanango
. M. State Farm, Palen Creek
utton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
hnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M., & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

nderson, J. H. & Sons, "Inverary", Yandilla
ngel, W. D., "Summerhill", Murgon
ill, W. W., Mathalla
utton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Kirby, A. E., "Lockington", Bogantungun
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Hereford

Messrs. Wilson & McDouall, Calliope Hereford Stud, Calliope

Poll Shorthorn

eonard W. & Sons, Welltown, Goondiwindi
Q.A.H.S. & College, Lawes

Why Not Two Crops at a Time?

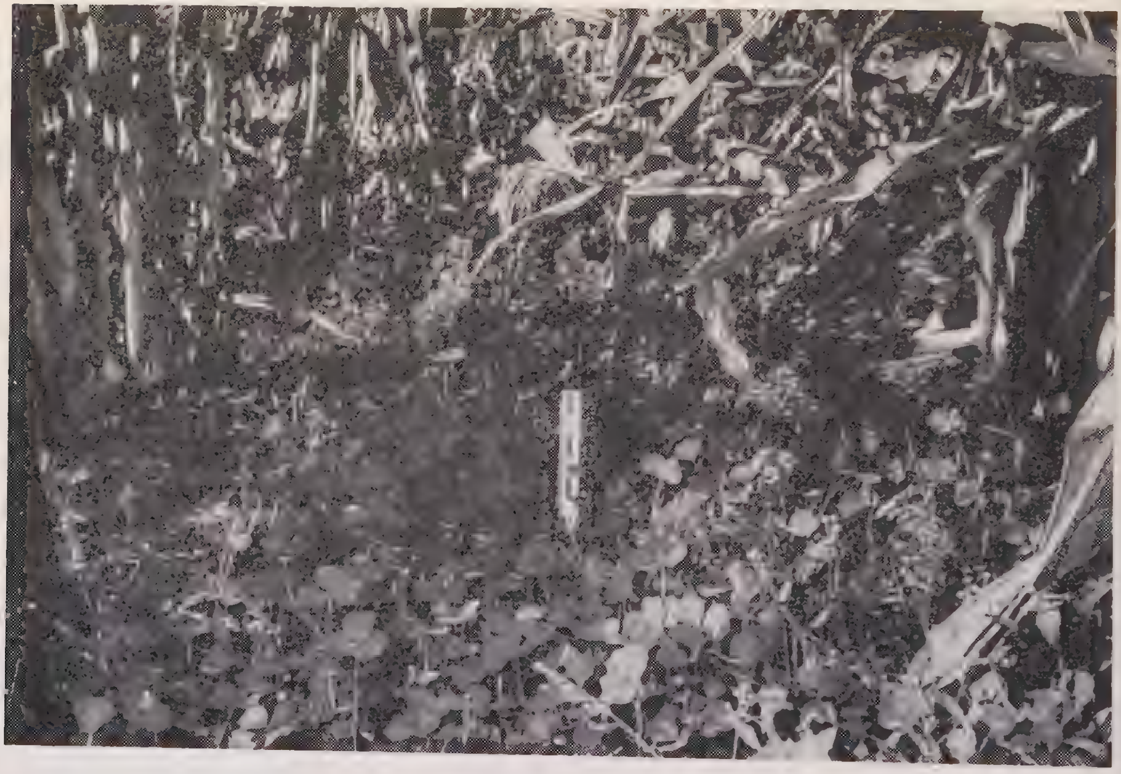


Plate 1: **Taken 29-5-61, this Photo Shows the Dense Stand of Pasture almost 12 in. High among the Maize:** The maize was harvested for grain on 16-6-61 and stock were then introduced for grazing.

C. A. SCHRODER, Assistant Irrigationist.

ne at a time is good fishing. But, with
s, why not try making it two? Any good
n crop ready for harvest is an impressive
t—a fish worth catching. But how much
e impressive if another good crop were present
ng it, ready to continue production when the
left off—this would be two at a time and
th having.

ith suitable soil and irrigation available to
plement rainfall, a good annual clover pasture
be expected to grow among maize every year.

he pasture grows from its own seed. It will
eady for grazing when the maize is harvested
should carry on to provide four or five good
ings between then and the end of October.

erimental Work

ubterranean clover has been grown success-
y as an irrigated annual winter pasture at the
ton Regional Experiment Station since 1952.

t grows well in autumn, winter and spring
normally provides four or five good grazings
ween early May and mid October, a period
n natural grazing is in short supply. It then
ers and seeds down and being a true annual
out completely.

riginal planting is made in early autumn
under suitable management it will regrow
n its own seed in about the second half of
ruary every succeeding year. Though annual
habit it is often referred to as a permanent
ual pasture because of its re-establishment
n its own seed every year.

During the clover dormant season of November to February the land is unproductive except for volunteer weed and grass plants which give little return. A small summer return has been obtained by including a very light seeding of lucerne at the original planting of clover.

Therefore the summer period which is actually the season of natural growth in the Lockyer is largely wasted in any area set aside for subterranean clover alone.

The rainfall, long days and warmth of summer add practically nothing to the farmer's income.

At the Gatton Regional Experiment Station, an attempt is being made to obtain a good return from the clover area in summer and to use the benefits of the rain and the warm conditions with the backing of irrigation in times of moisture stress.

With these things in mind an experiment is in progress to examine the possibility of producing a crop of summer maize in the subterranean clover area without appreciably reducing the normal seasonal winter grazing return from the pasture.

The experiment was commenced in 1957 and is still in progress.

The early work done in the trial was reported in the *Queensland Agricultural Journal* for November, 1959, under the title "Summer Maize and Winter Pasture Under Irrigation". This article listed the major benefits from the farming plan involved and included the performance of both the maize and the clover until the time of writing in June of that year. It should be read in conjunction with the present article. Reprints are available free of charge from the Department of Agriculture and Stock, William Street, Brisbane, or from local officers of the Department.

Looked at briefly, the system is essentially a rotational cropping practice incorporating an annual winter legume and a summer maize crop.

An interesting point is that there is an overlapping of crops from mid-February until the time that the maize is harvested, during which the two crops are growing in conjunction. In practice it has been found that subterranean clover and maize combine well and render a mutual benefit. The clover has improved both the soil structure and fertility level for the maize. On the other hand, cultivation of the maize for weed control provides a good seed bed for the clover to regenerate and develop while the shade from the maize protects the young clover seedlings if temperatures become abnormally high for clover.

The cropping system suits the stock farmer with irrigation. It provides very nutritious grazing at low cost over a period when natural feed is normally absent. It also provides a good crop of maize for silage or grain. The maize occupies the land at a time when it would otherwise be unproductive and it does not appreciably reduce the annual grazing return from the pasture.

Continuation of the Experiment

The experiment has been continued, and the fourth maize crop was recently harvested for grain.

The four years of experiment have led to the conclusion that a good clover pasture can be expected to grow among the maize every year and will re-seed.

If the maize is harvested for silage, the pasture should be ready for grazing some 6 weeks later. If it is harvested for grain, the pasture should be ready for grazing as soon as the maize is harvested.

A good yield of maize can be expected every year.

Farmers with irrigation and suitable soil can expect to obtain results similar to those obtained on the Station. No great skill or judgment is required though it is necessary to see that the clover is given opportunity to seed down well ea
year and to re-establish from that seed abo
February of the following year.

Results Year by Year

The results of the experiment year by year
outlined briefly as follows:—

First Year (1957-58).—For details see *Q.A*
for November, 1959.

Maize (planted in 6 ft. rows), 53 bushels
the acre.

Pasture yield per acre 22·94 tons.

In this season an area of the pasture land w
not planted to maize. The pasture was giv
normal treatment and its performance determin
for comparison with the clover that grew amo
the maize.

The total yield of the pasture where no ma
was grown was 23·51 tons to the acre wh
was only very slightly greater than from
pasture grown among the maize.

From these figures and from observation
the pasture growth and quality it was evident th
the maize crop in 6 ft. rows did not apprecia
reduce the annual grazing return from the pastu

Further comparisons in this relations
between the presence of maize and the pas
production were considered unnecessary.

Second Year (1958-59).—In this year, m
was grown in both 6 ft. and 4 ft. rows.
distance between plants in the rows was appro
mately 8¾ in. throughout giving plant populati
of 10,000 and 15,000 to the acre for 6 ft. a
4 ft. rows respectively.

Half the area of maize in each row width w
harvested for silage on 16-3-59 and the remain
for grain on 3-6-59.

Yields were:

	Silage Tons/acre	Grain Bushels/a
(*a*) Yield maize—		
6 ft. rows	15·3	117·1
4 ft. rows	21·7	151·5
	Silage Area	**Grain A**
(*b*) Yield pasture green material tons/acre—		
6 ft. rows	24·04	20·01
4 ft. rows	20·18	14·21

) Total green production, tons/acre of e for silage + associated pasture.

ft. rows .. 15·3 + 24·04 = 39·34

ft. rows .. 21·17 + 20·18 = 41·88

egarding the results for this year it is con- ed that it would have been beneficial to have eased the maize population in 6 ft. rows to 00 per acre (the same as in the 4 ft. row ing) by reducing the plant space within the s to approximately 6 in. Had this been done yields of both silage and grain in this row h would undoubtedly have been increased here were adequate supplies of soil moisture plant food present to support the extra plants.

hird Year (1959-60).—Maize yield, 6 ft. s, 27·5 bushels to the acre. Pasture yield, 59 tons to the acre.

onditions this year were very adverse for maize and pasture and the yields obtained t be regarded as particularly good under the umstances.

ctober, November and December, 1959, were h wetter than normal. This allowed only inadequate preparation of land for the maize and nut grass became very prevalent. The ze was eventually planted on 8-1-60 in 6 ft. s. Two inches of rain fell on 22-1-60. ortunately cows accidentally gained access the day and the crop was almost completely ed by grazing and trampling in the wet soil ditions. Many stalks were completely spoiled it is surprising that any crop resulted.

ut grass which had developed heavily in the lequate soil preparation provided very difficult ditions for the clover when it germinated in January/early February.

Vith so much nut grass present the clover did receive sufficient light for growth. It remained spindly weak plants until the nut grass growth vigour diminished with reducing temperatures April and May. The clover then grew idly and provided good grazing in June. Thus vithstood severely adverse conditions to finally vide a good pasture.

The first grazing commenced in June. This followed by good regrowth. Unfortunately en about ready for the second grazing it was identally sprayed with the hormone weedicide, butox. The pasture growth was very severely affected and it was feared that no viable seed would have been produced. However, ample quantities of good seed were later produced.

Fourth Year (1960-61 to 30-6-61).—Maize was planted in 6 ft. rows on 10-1-61. This was harvested for grain on 16-6-61. The yield obtained was 85·9 bushels to the acre.

Pasture (to 30-6-61).—The pasture was sampled and stock introduced for grazing immediately the maize was harvested. The green yield of pasture at the commencement of grazing was 8·06 tons to the acre. It was recorded that there was then a dense heavy growth of excellent pasture 12 in. high.

The pasture stand in this year at the first time of grazing appeared to be quite as good in every way as at any time in the history of the area. The good condition of the pasture is shown in Plate I.

Recommendations

The following recommendations are given as a guide to those desirous of following this farming plan:

(1) *Establishment.*—The clover pasture should be established as the first phase of the work. Subterranean clover is the pasture plant used. It gives a very good performance in autumn, winter and spring. Winter growth rate exceeds that of most other legumes. An important reason for its selection is that it is superior in its ability to regrow from seed among an existing maize crop.

Yarloop is the best all-round variety of subterranean clover used on the Station. It is an early variety. It seeds well and will succeed in heavy soils and wet conditions.

The seed, which is fairly large, can grow from a depth of several inches when necessary. The shoot is strong and a vigorous root system develops rapidly to enable the very young seedlings to go down deep and thus withstand several weeks of dry weather.

Planting should be done into a well-prepared seed bed in April or May if possible. June and July plantings can be made but the grazing return in the first year decreases with lateness of planting. From 6 to 8 lb. of seed to the acre is the amount for early planting. This should be increased to 10 or 12 lb. for later plantings.

This seed should be carefully inoculated with the recommended strain of inoculum.

First year pasture may be grazed at suitable intervals.

(2) *Seeding Down of Pasture.*—It is essential that good seeding down be obtained. This applies every year but is particularly important in the year of planting.

The seed usually matures early in November.

The stubble may be grazed if desired after the seed has ripened.

(3) *The Maize Crop.*—At the completion of grazing, the area should be ploughed shallow, about 3 or 4 in., and given normal preparation for planting to maize.

Planting is carried out when conditions are suitable between mid-December and mid-January. It is advisable to plant in 6 ft. rows. Individual plants should be about 6 in. apart. The reduction of plant distance compensates for the increase in row width.

The use of closer rows is not usually recommended. Close rows result in too much shading of the clover. This causes spindling of the clover and reduces growth rate and development, while the date of first grazing is delayed and seasonal yield reduced. The ill effects of close rows are less severe when the maize crop is used for silage than when used for grain production.

If intended for use as grain a fairly early maturing variety of maize should be used. Late-maturing, tall growing varieties are preferable for silage production.

Normal cultivation is given for weed control.

The final cultivation should leave a good seed-bed for the regeneration of the clover crop and should include hilling to facilitate later irrigation. Do not remove a good stand of clover seedlings by late cultivation.

The maize stubble is trampled by stock during grazing. It is ploughed with the clover stubble and has decomposed before the following maize crop is planted.

(4) *Grazing.*—If the maize is harvested for silage, the pasture should be allowed to grow on and reach good grazing condition before stock are introduced.

If the maize is allowed to mature for g the pasture has usually reached grazing stag the time the maize is ready for harvest.

Grazing should be carried out intermitt allowing the pasture ample time to recover make good growth before stock are re-introdu

As with all grazing, care must always exercised to avoid excessive defoliation of pasture at any time. Grazing should be w held during the period of major flowering ripening of seed.

(5) *Irrigation.*—The availability of irriga is essential for success. Annual winter pas will not succeed in the Lockyer Valley with irrigation in most seasons. In most summ maize crops at Gatton suffer reduced yi because of moisture stress at some stage growth. Application of irrigation at stress ti results in considerably increased yields. Irr tion requirements are not heavy. The t irrigation requirement for a full season of m and pasture together is about 18 in.

Normally the maize can be planted follow suitable rain and irrigation applied afterwards necessary.

When the type and slope of soil are suita irrigation can be by surface methods, and direction of maize rows should be arranged suit. Young maize is irrigated in suitable furro As it grows taller the maize is hilled, the being 4 to 5 in. high after settling. The provide the means of irrigating the maize in later stages and the pasture right through its

Spray irrigation may be used if conditions unsuitable for surface methods.

(6) *Fertilizer Application.*—Any nutri deficiencies in the soil should be corrected at time of the original planting of clover. Furt fertilizer application can then be made as requi by either maize or pasture.

The development of nodules on clover ro is frequently very slow in cold weather. If original planting is delayed until June or July is often desirable to apply one or more li dressings (56 to 80 lb. to the acre) of sulph of ammonia while the pasture is young.

Brucellosis-Tested Swine Herds (As at 8th October, 1961)

Berkshire

oth, B., Wyreema
e, E. J., "Kaloon", Mt. Alford, via Boonah
rane, S., "Stanroy", Felton
, F. R. J., "Astonvilla", Middle Creek, Pomona
ley, R. A., Rockthorpe, Linthorpe
rds, C. E., "Spring Valley" Stud, Kingaroy
Home For Boys, Westbrook
ner, A. C., "Myola" Stud, Jimbour
h, A., "Wilston Park", Pittsworth
. State Farm, Numinbah
ley, J. L., "Meadow Vale", Lockyer
ley, G. R., "Locklyn" Stud, Lockyer
s, I. M. (Mrs.), "Kenmore" Stud, Cambooya
, E. E., 225 West st., Toowoomba
er, E. R., Block 11, Mundubbera
D. T., "Rossvill" Stud, Aspley
J. C., "Bridge View" Stud, Yandina
ig & Sons, A. R., "Beau View" Stud, Beaudesert
der, P. L., Pozieres
r, A. J., "Woodlands Plains", M.S. 247, Nobby
H.S. & College, Lawes
onal Experimental Station, Hermitage
nberger, N., "Nevrose", Wyreema
nblatt, G., Rosevilla, Biloela
lback, B. A., "Redvilla" Stud, Kingaroy
h, E. F., "Grandmere" Stud, Manyung, via Murgon
, H. L., "Florida" Stud, Kalbar
es, G., "Wynwood" Stud, Oakey
r, V. F., "La Cresent", M.S. 544, Clifton
g, (Jnr.), W., Kybong, via Gympie

Large White

nbruck, C., Mundubbera
r, R. L., "Baroma", Glenapp, via Rathdowney
on Bros., "Chiltern Hill", Cooyar
, A. M., "Aleun", Wondai
ner, Dr. B. J. & Parnwell, A. J., Plunkett Rd., via Tamborine
bell, J. W., "Bunya", Bell
r, R. H., "Relloc", Tallegalla, via Rosewood
, F. R. J., "Astonvilla", Middle Creek, Pomona
sen, B. L. R., Wondai
er, R. J. & E. A., "Dowlea", Tingoora
an, C. P., "Colley", Flagstone Creek
er, S., "Kenstan", Pittsworth
ke, H. J. and Son, "Delvue" Stud, Cawdor
awin Stud Farm Pty. Ltd., Samford
ons, A. E. H., Mt. Glorious
on, H., "Thistleton", Wootha Rd., Maleny
ser, D. H., "Yagaburne", Goondiwindi
I. State Farm, Numinbah
M., "Milena" Stud, D'Aguilar
ling, Sir James, "Highfields',, Murgon
son, K. L., "Warree", Tableland Rd., Calliope
, T. W. & S. J., Mirridong Farm, Upper Forest Springs, .S. 74, Clifton
on, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
on, G., "Grajea" Stud, Toowoomba
s, K. B., "Cefn" Stud, Clifton
er, J. & S., "Karajoy", East Nanango
owski, A., "Exton", Pechey
hard, R. B., "Collar" Stud, Warwick
en, H. L., "Oakway" Stud, Kingaroy
D. T., "Rossvill" Stud, Aspley
, J. C., "Bridge View", Yandina
geiger, L. C., "Bremer Valley" Stud, Rosevale, via Rosewood
k, A. J., "Culzean", Mundubbera
rcliff" Stud, Wecker Rd., Mt. Gravatt
sen, A. R., Ascot, via Greenmount
ner, V. P., & Son, "Remlap", Greenmount
ne, F. & P., Beerburrum
Curtis Co-operative Dairy Association Ltd., Stud Piggery, loela
le, R., "Yarallaside" Stud, Pittsworth
er, N. R., "Actonvale", Wellcamp
ell, R. S., "Kybong", Gympie
.H.S. & College, Lawes
el, V. V., Coalstoun Lakes
el, R. M., "Turua", Coalstoun Lakes
onal Experiment Station, Biloela
onal Experiment Station, Kairi
inson, O. R. & O. J., "Linvale", Argoon, Biloela
enblatt, G., Rosevilla, Biloela
wick, F. G. & J. E., Mundubbera
n, L. W., "Hodgson Vale", via Toowoomba
hen, T., Withcott, Flagstone Ck.

Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Trim, R. A., Gold Creek Rd., Brookfield
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

Tamworth

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Salvation Army Training Farm For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

Wessex Saddleback

Cooper, G. J., Neumgua
Coulson, B. L. R., Wondai
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn", M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzean", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

Landrace

Alexander and Lundie, "Vanda", Biddeston
Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Burnett, E. V., "Glenden", Tabooba, via Beaudesert
Carmichael, D. J. & J. P., "Junelea", Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Coulson, B. L. P., Wondai
Coulson, Mrs. H. M., Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crawford, R. J. and Sons, "Inverlaw", Kingaroy
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla", Killarney
Hickson, K. L., "Warree", Calliope
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jarvis, O., Wondai
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., 225 West St., Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R. Ascot, via Greenmount
Nielsen, B. J., "Glen-View", Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton", M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Port Curtis Co-op. Dairy Assn. Ltd., Stud Piggery, Biloela
Powell, R. S., "Kybong", Gympie
Radel, R. M., "Turua", Coalstoun Lakes
Rosenblatt, G., "Rosevilla", Biloela
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Trim, R. A., Gold Creek Rd., Brookfield
Weier, V. F., "La Crescent", M.S. 544, Clifton
Young, R. & C., "Dudley Park", Biggenden

Large Black

Pointon, E., Goomburra, M.S. 869, Allora

Growing Passion Fruits And Granadillas

By J. McG. WILLS, Senior Adviser in Horticulture,

S. E. STEPHENS, Horticulturist,

And H. M. GROSZMANN, Senior Plant Breeder.

Several tropical and subtropical plants in the family *Passifloraceae* are grown commercially in Queensland for their distinctive fruits. The better known species are the passion fruits (purple, golden, hard-shelled passion fruits and the bell apple) and the granadillas.

PURPLE PASSION FRUIT

The purple passion fruit (*Passiflora edulis*) is a semi-woody climber which is native to Brazil and thrives in a wide range of climatic conditions. Commercial production of the crop in Queensland, however, is largely confined to southern districts.

The plant is a short-term perennial which is heavily clothed with dark-green, deeply lobed leaves with elongate tendrils in their axils. Large and showy bisexual flowers are borne singly in the leaf axils on jointed stalks. The fully ripe fruit is purple in colour with a smooth, hard skin and an edible pulp containing many seeds. The pulp is an important ingredient in both fresh and canned fruit salads.

Climatic Conditions

The vine thrives in the warm, humid coastal areas of central and southern Queensland and on the tropical highlands. Self-sown plants are commonly found along the edges of rain-forest clearings.

Under normal conditions, soil moisture in the coastal areas is adequate for the crop during most of the year with the exception of spring and early summer. If dry weather occurs during this period, partial defoliation and loss of fruit may be expected in areas where irrigation is not practicable.

In central and southern Queensland, frosts are rarely severe on the slopes of the coastal ranges and near the sea where the crop is usually gro Although light frosts do little harm to the vi the area selected for passion fruit should, wh practicable, be free from frost.

Cropping Habit

The period between planting and first fruit depends chiefly on the time of planting and vigour of the vines. Healthy plants establis in spring may produce a few fruits withi months and bear a commercial crop in from 9 15 months. When autumn planting is practis a light crop may be harvested in from 9 to months but the first full crop matures 12 mo later. In some localities, two crops are bo each year—a main summer crop and a second winter crop. Blossoming for the summer c takes place during August, September October and for the winter crop during Febru and March. The period from fruit setting harvesting is about 10 weeks. Marketing of summer crop commences in October and m extend to January, the heaviest pickings be made in November and December. The win crop is usually harvested in May and June.

Occasionally intermediate off-season crops obtained, the most important of these be harvested from February to March.

Selection of Site

Factors which should be considered in sele ing a site for a passion fruit plantation are aspe elevation, shelter, soil, drainage and accessibili

In southern Queensland the aspect should from east to north, open to the morning sun a backed by rising ground or dense natural timb to protect the area from westerly or southe winds. Such slopes are naturally warm. In t pics and close to the sea, aspect is of secondary portance but the vines require some protection m persistent south-east trade winds.

The passion vine grows satisfactorily in fertile, ll-drained loams. Stagnant water at the roots, wever, is fatal. Soils which are poor in ganic matter dry out rather quickly, but this fect can be rectified by growing cover crops ring the summer and turning them in during e autumn and winter months.

nd Preparation and Planting

The land should be well cultivated before anting so that the young vines can establish emselves rapidly and develop a good root stem. The initial ploughing should be deep d subsequent cultivation is then designed to oduce a good tilth. On rocky or steep land hich cannot be ploughed, the soil may be broken with mattocks or steel-pronged forks. Preration should begin about three months before anting so that any rain which falls will be nserved for the use of the crop.

Coastal soils are frequently acid, and if the I of the land is less than 5·5, from 1 to 2 tons r acre of lime or dolomite should be applied ior to planting.

Usually 12-20 ft. is allowed between the llised rows and 8-16 ft. between plants in the w. The row spacing is determined mainly by e equipment used for operations such as cultition and spraying, but the plant spacing varies th the fertility of the land; the better the land, e greater the distance between plants. When e vines are planted too close in the row, the liage becomes very dense in the second year d it may then be necessary to remove every ternate vine if the area is to be retained for a nger period.

ellising

The purple passion vine is grown commercially a trellis. The trellises are run in a north-uth direction wherever possible so that the nlight will be evenly distributed over the vines. n hillside plantations, it is not always practicable observe this rule and the vines are then planted ross the slope.

In commercial vineyards, trellises are mainly two types, the vertical and the horizontal. In th cases, the hardwood posts are 7½ ft. x 7 in. 4 in. in dimensions. They should be set 18 in. in the ground. The strainer posts at the end of each row are of heavier timber and may be either round or split; they should be set 2 ft. 6 in. in the ground and well stayed. One strainer to every 80 yd. of trellis will prove sufficient in most locations.

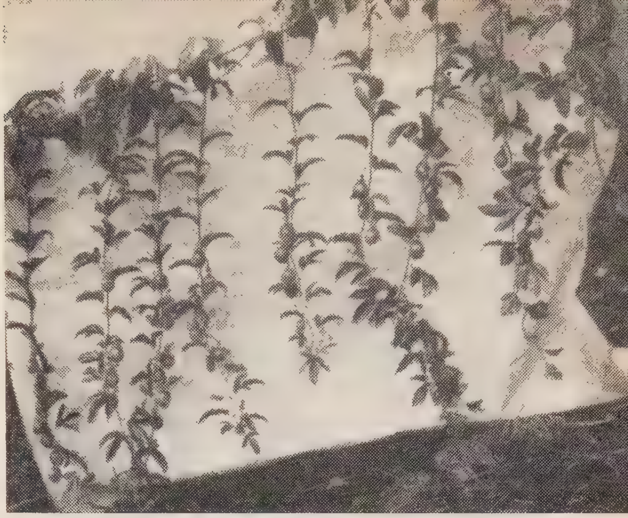
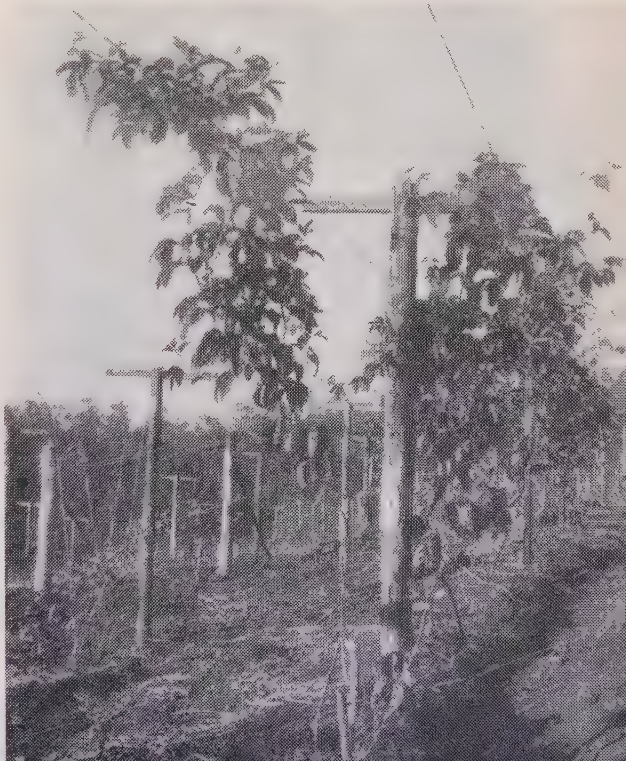


Plate 1. Cropping Habit of the Passion Vine. Note the main leader and fruit-bearing laterals.

Plate 2: Passion Vine Trellis. The vines frequently are trained to a two-wire horizontal trellis.



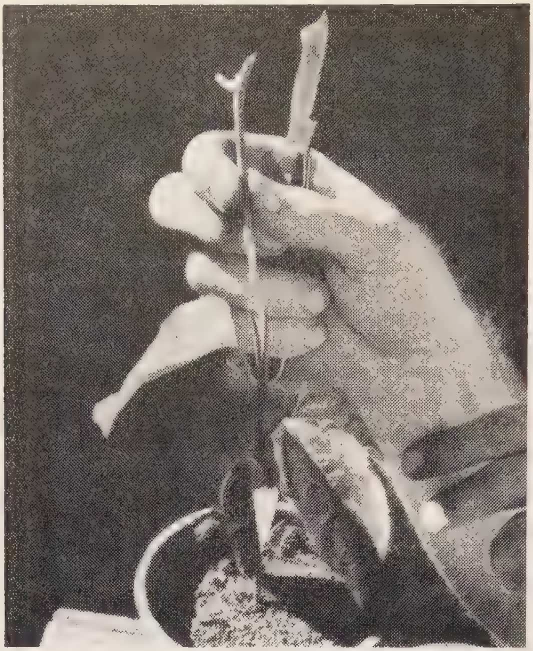


Plate 3. Propagating Wilt Resistant Vines. The *flavicarpa* rootstock is prepared for cleft grafting with an *edulis* scion.

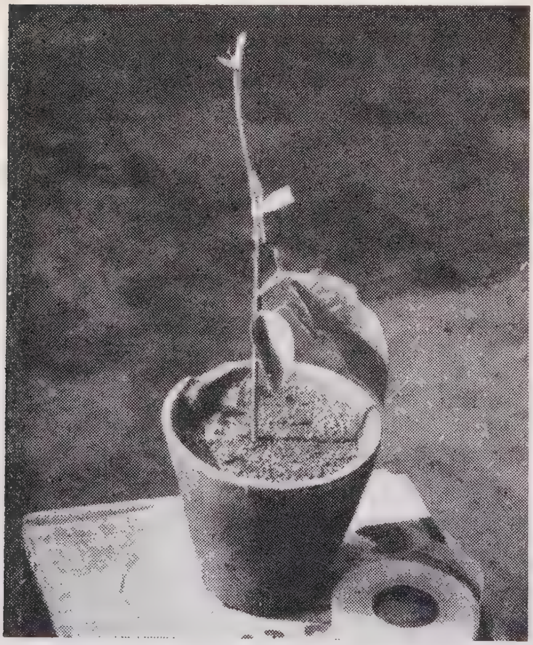


Plate 4. Propagating the Wilt Resistant Vine. The completed graft with the *edulis* scion tied in position.

In the vertical trellis, holes are bored in
posts to take the wires. One is close to the
of the post, a second is 12 in. lower and the th
may be 15 in. or so nearer the ground.

In the horizontal type of trellis, two wires
about 6 ft. above ground level at a distance
about 2 ft. from each other. They are kept
position by 2 x 2 in. cross members, each
which is 2 ft. long and fastened to the top o
post. The wires pass through holes or fit i
grooves at the ends of the cross member. Sing
wire trellises are used in some areas.

The wires must be strained to prevent heav
laden lateral shoots from sagging to the grou
Small cast-iron rollers are excellent for this p
pose, being easily operated and always in positio
Various gauges of wire are used in the trellis b
No. 8 galvanised iron wire is popular. Sho
the wires sag during the cropping season, stak
may be erected between the posts to support th
until the fruit has been harvested. The wi
may then be tightened when pruning is complet

Propagation

The purple passion vine is usually propagat
on a wilt resistant stock such as the gold
passion fruit (*P. edulis* forma *flavicarpa*).

The seed of both the golden passion fruit a
the purple passion fruit is sown in spring
shallow drills about ½ in. deep and about 6
apart. After sowing the soil is covered with
light mulch. Provided it is kept moist, t
seedlings will appear aboveground in some 2
4 weeks. When they are about 2 in. high t
flavicarpa seedlings are transferred to small p
or other containers for grafting when 9 to 12 i
high. At the same time, the purple passion vi
seedlings should be thinned out to about 4 i
apart, and left to grow on in the bed. Grafti
can be done simply by the cleft graft.

In cleft grafting, the stock is cut off square
about 6 in. above the ground and then split dow
the middle for about 1 in. with a sharp knife
a safety razor blade. A small piece of tipwoo
about 3 in. long from a purple passion vin
seedling is used as the scion. Its larger leav
are removed and the bottom end is cut to a fin
wedge and inserted in the cleft in the stock an
the union bound completely with a narrow str
of thin polyvinyl plastic tape. Wood from farthe
back with one or two buds can be used in th
same way and, being less tender, is easier t

handle. As the more mature wood is often hollow, the wedge cut may be two pronged, but this will not affect the graft.

The newly grafted plants should be shaded and protected from wind for a few days until the union has taken. In about 2 weeks the graft will be quite strong and the plastic tape can be removed.

Grafting on potted rootstocks has been described as this method reduces the risk of losses when transplanting into the field. However, it is possible to graft well spaced *flavicarpa* plants in the bed and transplant to permanent field positions if sufficient care is taken in transplanting. This involves the selection of suitable weather or the provision of shelter for the new transplants.

When planting grafted vines in the field, keep the union well above the ground. Any suckers developing from the stock below the graft should, of course, be rubbed off as they appear.

Transplanting

Grafted plants are usually transplanted between November and February. March-September plantings are generally undesirable as growth may be checked by cool temperatures in winter and lack of soil moisture in spring.

Plants which are about 9 in. high may be safely transplanted. Dull, cool, or moist weather should be chosen for transplanting, but care is necessary to ensure that the roots do not dry out before they are set in the plantation.

Large holes about 12 in. in diameter and 12 in. deep are dug in each vine position midway between the trellis posts. One plant is placed in each hole, the roots being spread evenly in a downward direction before the hole itself is filled with surface soil. Plants should be set at the same depth as in the nursery and watered immediately afterwards.

Training the Vine

Within a few weeks after transplanting, numerous lateral shoots appear at the crown of the plant and many of them outgrow the original terminal. When they attain a length of 12 to 18 in., one or two of the more vigorous are selected to form the framework of the vine and all other shoots carefully cut away. A light stake is driven into the ground alongside each seedling and fastened firmly at the top to the trellis wire; this supports the vine until it reaches the wire and can support itself. The young vine is tied to the stake at intervals of about 12 in. in order to prevent wind damage. If a leaf stalk and tendril—not the actual stem—are tied to the stake, there is no necessity for removing the tie later on. Stakes may be replaced by a V

Plate 5. Young Passion Vine. Trained to a single main stem on a three-wire horizontal trellis.

Plate 6. Passion Vine. Showing leaders trained along wires.

Plate 7. **A Cover Crop of Field Peas in Young Passion Vines.**

Plate 8. **Pruning the Passion Vine.** The laterals are cut back to a length of about 12 in.

string joining the trellis wires to a peg at the base of each vine; in this case, ties are unnecessary as the leaders support themselves when wrapped round the string.

All side branches arising from the stem between the ground and the wires should be snapped off when they appear and axillary buds may be cut out at the same time to prevent re-growth in these positions. In multiple-stemmed vines, a damaged stem can be replaced by a lateral shoot. Vines trained to a single main stem take longer to cover the trellis than multiple-stemmed vines but are easier to control as the vegetative growth is less dense. On sloping land, where trellises have been erected up and down the slope and not on the contour, each leader is trained uphill on its own wire.

On the Vertical Trellis.—In the single-stemmed vines grown on a vertical trellis, the tip is pinched out when the leader reaches the bottom wire. The stem will then throw out side branches near the top. Three or four of these branches which are growing close to each other are selected and the others removed. Two of these branches are trained in opposite directions along the bottom wire. A third may be carried up to the top wire, where the tip is pinched out to promote development of further side branches which can be trained in opposite directions along the top wire. Sometimes two branches formed after the first pinching are carried to the top wire and trained in opposite directions.

When two main stems are allowed to grow from the ground, the tip of one should be pinched out when it reaches the bottom wire and two laterals are later trained in opposite directions along it. The second stem is taken up to the top wire, where it is similarly trained.

On the Horizontal Trellis.—With the horizontal trellis, the tip of a single-stemmed vine may be pinched out when it reaches the wires and the laterals which develop are trained in opposite directions along each of the two wires. In two-stemmed vines, one stem is carried to each wire and its two laterals trained in opposite directions along the wire.

The part of the vine which grows along the wire is termed a leader. Leaders should be given long gradual turns around the wires and tied loosely at intervals. All turns must be made in the same direction to prevent sagging. Lateral growth can be accelerated by nipping out the terminal of the leader as it approaches the neighbouring vine. The laterals should be encouraged to grow straight down; if this is done the vines remain open and spraying, harvesting and pruning operations are simplified.

Plantation Management

The passion vine is a comparatively shallow-rooted plant and after the crop is established. cultivation should be kept to the minimum; it is required only for the control of weeds and to prevent caking of the surface soil. Care is essential when weeds are being chipped around the vines, for injury to the stem and main roots is often followed by base rot. It is preferable to pull all weeds in the vicinity of the stem by hand.

Green Manuring

A green manure crop may be planted between the trellises after storm rains in early summer to provide a ground cover for the wet season. Poona pea and other types of cowpea are suitable for the purpose. On soils where difficulty is experienced in getting Poona pea to grow, pigeon pea will generally provide a good first crop if sown in spring. In either case, the green manure crop can be mowed in autumn or disced in July.

Green manure crops planted subsequent to the first year's growth of the vines should be confined to a 4 ft. strip along the avenue.

When passion fruit are grown on virgin land, a green manure in the standing crop is generally desirable. If, however, some vines have collapsed from root rot, discing in the green manure may tend to spread the disease. Under these circumstances, it is better to mow the cover crop and leave the residues on the surface of the ground.

Fertilizing

The passion vine requires a plentiful supply of plant food. On fertile virgin land, no fertilizer will be needed for the first year or two after planting. On land which has been previously cropped, and in all plantations which are more than 2 years old, a fertilizer programme is normally essential. The amounts required will depend to some extent on the vigour of the vines; rates of application of 4 lb. per vine per annum are commonly used. The fertilizer is applied in two equal dressings, the first in the July-August period and the second in December-January. A 5:13:5 or similar mixture which is high in phosphoric acid is satisfactory. If necessary, this may be supplemented by a dressing of sulphate of ammonia in spring at the rate of 1 lb. per vine.

The fertilizer should be placed in a band round, but not close to, the base of the vine. Once the vines have filled the trellis, broadcast applications are permissible.

Irrigation

If the crop is irrigated, the vines can be kept growing and blossoming almost throughout the year. The plants can therefore be pruned whenever convenient and forced into new growth for the production of another crop. Overhead spray systems are generally used in areas where irrigation is practised, either because the water supplies are limited or the topography of the land is not well suited to furrow irrigation.

Pruning

Pruning serves a variety of purposes in the passion vine plantation; dead wood is removed, the vines are opened up, the production of fruit-bearing laterals is increased and the harvesting period is brought under control.

Passion vines should be heavily pruned once each year, usually in July or August after the winter crop has been harvested.

Under ordinary circumstances, heavy pruning in winter produces a big summer crop and a somewhat smaller winter crop. However, by shortening back the flowering laterals in October and sacrificing portion of the summer crop, the size of the intermediate crop can be increased if weather conditions are favourable. Similarly, by shortening the flowering laterals in February a late winter crop can be secured.

In the winter pruning, all laterals are severed about 12 in. below the trellis wires with a reaping hook or cane knife. By this means, the bulk of the current year's growth is removed and it is possible to get a clear view of the framework of the vine. Dead and unthrifty wood is then cut away with secateurs and the stronger laterals are shortened to about 12 in. Each of these laterals will have two or three buds to provide new canes for the following crop.

Replanting

The commercial life of a healthy passion vine is about four years. Many plantations are short-lived, however, owing to the inroads of disease, and some provision must therefore be made for continuity of production on the farm. In a well-managed plantation, new vines should be coming into bearing either every year or every alternate year. On most properties, this involves some form of crop rotation and a planting programme in which individual crops are some distance from each other or separated by tall vegetation to lessen the risk of disease infection. This risk may be reduced to some extent by the prompt destruction of old vines which no longer bear commercial crops of fruit.

Under a rotational system of crop management, additional trellises are necessary but the expense can be offset by the returns from vegetable and other crops grown in trellised areas which are being spelled from passion fruit.

Harvesting and Packing

The crop should be gathered daily in the early morning or the late evening when the fruit is cool. All fruit on the ground is picked up first, as even a short period of exposure to the sun may cause severe scalding and make the fruit unsuitable for sale.

Good colour is essential and during cool weather the fruit should be picked when the rind is a deep purple. In the summer, the fruit is gathered when from half to three-quarters of the surface skin has a purplish tinge. Fruit which is harvested in wet weather should be allowed to dry before it is packed.

All fruit should be carefully picked to prevent the skin being damaged. By grasping it in the hand with the thumb and forefinger on the fruit stalk and pressing forward with the thumb and backward with the forefinger, the mature fruit is easily detached. Fruit should be placed—not dropped—into picking boxes or tins which are kept under shade and sheltered from strong winds.

Passion fruit consigned to the fresh fruit market is packed in half-bushel dump cases. Fruit sent to the factory may be forwarded in sugar bags or similar containers.

On well-cared for vines a return of 200 half-bushel cases per acre can be expected from the first main summer crop.

GOLDEN PASSION FRUIT

Although the fruit of the golden passion fruit (*P. edulis* forma *flavicarpa*) differs considerably from that of the purple passion fruit, the vine is similar. It is more vigorous, however, and thrives better under tropical conditions. The tendrils, leaf stems and primary veins are purplish and the same colour character is conspicuous on the flower. The fruit is usually almost spherical. When immature, the skin is mottled with white spots, but the ripe fruit is a pale, golden-yellow colour.

The golden passion vine flowers profusely but shows a tendency to self-incompatibility. Normal cropping can therefore be expected only when several seedling vines are planted in close proximity. Natural cross-pollination will then occur and ensure a satisfactory setting of fruit.

Golden passion fruit contain a larger amount of seed pulp than purple passion fruit, and the pulp is both more aromatic and more acid. Hybrids between the purple passion fruit and the golden passion fruit occur in north Queensland. The best of these have large oval fruits with a claret-coloured skin and the pulp is intermediate in flavour and aroma between that of the two parents.

Cultural practices for this variety are the same as for the purple passion fruit.

BELL APPLE

The bell apple (*P. laurifolia*) is native to Brazil and the West Indies and is fairly commonly cultivated in Malaya, from which country it has been introduced into Queensland. It is often known as the Singapore passion fruit.

Unlike most of the Passifloras, the leaves are laurel-like, dark-green and closely placed on the stems so that the vine is densely foliaged. The flowers are borne in profusion and are both handsome and fragrant. The fruit is ellipsoidal, up to 3 in. long, orange-yellow in colour and partly enveloped by three large green bracts. The skin is soft and spongy and encloses a fragrant seed pulp with a pear-like flavour.

The plant grows readily from seed or cuttings and thrives in most fertile soils. However, it is strictly tropical in its climatic requirements and is grown successfully only in north Queensland.

Fruit setting is unreliable but is generally best on a horizontal trellis of the type used for granadillas. Hand pollination will ensure a good fruit set on some vines but is ineffective on others. Flowering occurs during the greater part of the year if moisture is abundant and humidity is high.

HARD-SHELLED PASSION FRUIT

The hard-shelled passion fruit (*P. maliformis*) is a native of tropical America and the West Indies. In many English-speaking countries overseas, it is commonly known as the sweet calabash.

The vine is slender and relatively small with entire ovate leaves up to about 6 in. long. The attractively coloured flowers are similar to those of other passion fruit but the front of the calyx lobes is dotted with reddish-brown. The flowers are also enclosed in three large cream coloured bracts which persist and envelop the fruit. The fruit is small with a very hard shell and the pulp is inferior to that of the purple passion fruit.

The hard-shelled passion fruit has little value as a commercial fruit. However, it is hardy and apparently immune to the attack of certain pests and diseases that cause much loss in some other Passifloras.

GRANADILLA

The small-fruited granadilla (*P. quad-angularis*) and the large-fruited granadilla (*P. uadrangularis* var. *macrocarpa*), both of which row well in north Queensland, are native to opical America. They are similar in growth, owering and fruiting habits but the fruit of the nall-fruited variety is 6-8 in. long while that of he large variety grows up to 12 in. in length. The small-fruited type contains relatively more seed pulp than the variety *macrocarpa,* but the atter has a thicker and better flavoured flesh.

The granadilla is essentially a tropical plant, nd is particularly susceptible to damage by frost. High temperatures accompanied by high humidity re necessary for fruiting; under dry atmospheric onditions the flowers produce little or no pollen nd the fruit set is consequently poor.

A fertile soil with good moisture-holding apacity and free drainage is essential for good rowth of the plant. Silty alluvial soils are most uited to the crop but any well-drained loam may be planted in tropical areas.

The Trellis

The vine is supported on a horizontal trellis nown as the granadilla shed. This special tructure is 7 ft. high with the posts set on the quare at 10 x 10 ft. spacings. The tops of the posts are tied with wooden rails which in turn upport plain wires spaced at intervals of about 18 in. It is usual to build the shed in several ections. The granadilla shed must be solidly onstructed with well-stayed end posts, for it has o support a considerable weight.

Propagation and Training

The granadilla may be grown from seed or rom cuttings. Seed must be quite fresh as it etains its viability for only a short period. Germination takes place in 14-21 days and the seedlings can be set out in the trellis when they are 6-12 in. in height.

During the summer wet season, cuttings strike readily. They should be cut in lengths of 15-24 in. from vigorous lateral branches of the vine. After the leaves on the lower two-thirds of the cutting are removed, the cutting is planted in well-prepared soil at the foot of a trellis post with about one-third of its length out of the ground. Two cuttings are usually planted alongside each trellis post; if both grow, the less vigorous is removed. When plants are established at the base of each supporting post of the granadilla shed, the vines quickly cover the trellis. After the first fruiting, the shed may become overcrowded and it is then necessary to remove every second vine by cutting it at ground level.

Young plants make very rapid progress if a support is provided for the climbing vine. A bamboo top with side shoots intact makes an excellent support with ample contact points for the trendrils of the vine.

Early training of the granadilla plant requires the removal of side shoots as they develop and also any suckers arising from the stem near ground level. These shoots break off easily when they are only a few inches long. The plant should be trained to a single stem until it reaches the overhead trellis. When this stage has been reached, the terminal bud can be removed and two main arms allowed to develop. These main arms are so spaced on the wires that the shed will be evenly covered. Laterals will develop at intervals along the main arms and spread across the adjoining wires so that the whole plant receives adequate support.

Fertilizers

Fertilizers containing organic nitrogen are considered most suitable for the granadilla vine. A complete mixture with a 7:10:10 or similar formula should give good results if two dressings are made at a rate of 1lb. to 2 lb. per vine, the first in spring and the other immediately after the summer wet season. If the vines lack vigour in early summer, a supplementary dressing of sulphate of ammonia at the rate of ½ lb. per vine can be applied at that time. Adequate supplies of organic matter should be maintained in the soil by applying a surface mulch at regular intervals.

Fruiting and Harvesting

The fruit is set on new wood and the crop is normally less seasonal than that of the purple passion fruit. Fruit in all stages of development can usually be found on a vine at any season of the year. There are, however, two main crops, which mature in autumn and early spring. The small-fruited granadilla sets freely by natural pollination but the large-fruited variety usually requires hand pollination to secure a good crop. The best results are obtained by pollinating the flowers within 4-6 hours after the buds open.

The period from flowering to fruit maturity is approximately 11 weeks. Maturity is indicated by a change in colour from green to yellow at the apex of the fruit. As ripening progresses further, the whole skin changes to a bronze-yellow shade and the flesh becomes soft. For market purposes, the fruit should be harvested when the first change of colour is observed. It can be clipped from the vine with secateurs or spun round several times until the stem breaks. Baskets or crat padded with woodwool should be used wh harvesting the fruit, and any risk of damage transit to market can be reduced by packing woodwool.

Yield from a small-fruited granadilla vine full crop is in the vicinity of 6 to 10 dozen fru per year, but from the large-fruited variety it seldom more than 2 or 3 dozen per year.

Field Day in the West

Progressive Husbandry Practices in the Miles Cattle District Are Discussed at Field Day Gatherings Such as the one Pictured Here. See page 655 for article on producing beef in the Miles area.

Culling For Fleece Weight Without The Use of Ear Tags

By A. W. BEATTIE, Biometrician.

This article shows how to cull flock sheep for low fleece weight without the use of ear tags.

The method of classing involves shearing a sample run to estimate the fleece weight below which sheep are to be culled. The main mob is then shorn and sheep with fleece weights well above or below the culling mark are branded distinctively as definite selections or culls. Sheep with fleece weights close to the culling mark are branded separately to allow for any inaccuracy in the estimated culling mark.

METHODS FOR CULLING DIFFERENT PERCENTAGES FROM A FLOCK WITHOUT USING EAR TAGS ARE SET OUT AS FOLLOWS :—

Method for Culling less than 20 per cent.	Method for Culling 20 to 40 per cent.	Method for Culling more than 40 per cent.
1. Cull by eye for serious faults, for example, black wool, undershot jaw, and in the case of ewes excessive skin folds or face cover. This culling should be as light as possible with no attention to cut per head. Leave this to the scales	1. As for Column 1	1. As for Column 1
2. Set the sample size at 50 to 100 sheep	2. Set the sample size at 30 to 50 sheep	2. Set the sample size at 30 to 50 sheep
3. Take the sample by running sheep through the drafting race and taking out every tenth sheep (or twentieth or whatever is required) to give a sample size in range shown	3. As for Column 1	3. As for Column 1
4. Guess the average fleece weight of the sample sheep. As they are shorn and their fleeces weighed, brand them distinctively as— Above the average which you guessed Less than 1 lb. below the average which you guessed 1 lb. or more below the average which you guessed	4. As for Column 1, but branding the sample sheep can be omitted if flock is large (500 or more)	4. As for Column 1, but branding the sample sheep can be omitted if flock is large (500 or more)
5. As the fleece of each sample sheep is weighed, enter the weight on a sheet such as that shown in Table 1. This automatically arranges the weights in ascending order	5. As for Column 1	5. As for Column 1
6. Count up from the lowest cutter to find the fleece weight which breaks this sample into the required percentage of culls and selections, and draw a dividing line at this mark	6. As for Column 1	6. As for Column 1

Methods for Culling Different Percentages from a Flock Without Using Ear Tags Are Set Out as Follows:—*continued*

Method for Culling less than 20 per cent.	Method for Culling 20 to 40 per cent.	Method for Culling more than 40 per cent
7. Count 4 sheep either side of this mark and draw two more provisional dividing lines	7. Count 5 sheep either side of this mark and draw two more provisional dividing lines	7. Count 6 sheep either side of th mark and draw two mo provisional dividing lines
8. Whenever there is doubt about where to draw the dividing lines take the fleece weight up a little rather than down	8. As for Column 1. (See examples of this in Table 1)	8. As for Column 1
9. Using the three dividing lines estimated from the sample, proceed with the shearing of the main mob. As each fleece is weighed, brand the sheep distinctively as— Selection Probable selection Probable cull or Cull	9. As for Column 1	9. As for Column 1
10. After shearing draft all sheep into their respective groupings, count them and make whatever adjustment is needed to end up with the required number of culls	10. As for Column 1	10. As for Column 1

System in Practice

Here is an example of the system in practice:

Aim.—To cull 30 per cent. of a flock of 357 young ewes. These sheep had survived a preliminary culling on faults.

The sheep were run through a race and every twelfth animal was drafted off to obtain a random sample of 30. On past experience it was thought these sheep should, on the average, cut around 8 lb. of wool.

As each sheep in the draft was shorn, its fleece was weighed and the weight to the nearest tenth of a pound was recorded on a prepared sheet (see Table 1). If this form of recording is used, all that is required is a tick in the appropriate square; for example, the lowest cutter in this lot had a 5·8 lb. fleece, the next lowest 6·4 lb., then there were two at 6·5 lb., and so on.

If a sheep cut more than 8 lb. it was branded blue on the back. If it cut 7 to 8 lb. it was branded with two dots, one blue, one red, and below 7 lb. red on the back.

When the weighing sheet was complete it was found that 9 sheep (9 = 30 per cent. of 30) had fleece weights of 7·1 lb. or below. Th culling mark (heavy line in Table 1) was, therefore, struck between 7·1 and 7·2 lb. There were 5 sheep (the choice of the number 5 is discussed later) in the range 6·7 lb. to 7·1 lb. and this was taken as the range of "probab culls". In the table a further dividing line is shown between 7·7 lb. and 7·8 lb. five sheep above the culling mark to separate the "probab selections" from the "definite selections".

The remainder of the flock were then shorn Each fleece was weighed and the sheep branded in the counting-out pen:

Fleece 7·8 lb. and over	Blue shoulder	(138
Fleece 7·2 to 7·7 lb.	Blue rump	(99)
Fleece 6·7 to 7·1 lb.	Red shoulder	(64)
Fleece 6·6 lb. and below	Red rump	(26)

The numbers in brackets are the numbers o sheep which ended up in each group when they were drafted and counted after shearing. A well as these animals there were the origina sample 30. Referring again to Table 1, there were:

Fleece 8·0 lb and over . . . . Blue on back (10)
Fleece 7·0 to 6·9 lb. . . . . Blue/red back (14)
Fleece 6·9 and below . . Red back (6)

A 30 per cent. culling rate means that 107 sheep should have been culled to leave 250 selections. This number was made up by classing in—

From the main mob: All the blue shoulder and blue rump sheep;

From the sample: All the blue back sheep and the three best looking of the blue/red back sheep;

to give 138 + 99 + 10 + 3 = 250 selections.

Another equally good way of making up the total would have been to keep all 14 of the blue/red back sample sheep and drop 11 of the 99 blue rump animals.

Since this was a trial of the method, the fleece weights of all the sheep were recorded. This is not an essential part of the system, but it did permit an assessment of its success in this case. The average fleece weight of the whole mob (357 sheep) was 7·62 lb. If all the sheep had been individually identifiable the average of the very best 250 would have been 8·01 lb. The average of the 250 actually selected without the use of ear tags was 7·98 lb. This system of culling may not always work out quite so well as this, but unless one is exceptionally unlucky in taking the preliminary sample, its efficiency will always be high.

A sample of 30 was taken in this trial. This is suggested as a minimum number. If fewer than 20 per cent. of the flock are to be culled, the sample should be at least 50. Otherwise the proportion of definite culls branded from the rest of the mob will be too small.

The dividing lines between definite and probable culls and between definite and probable selections were drawn by counting 5 sheep above and below the culling mark. If too few had been taken there would have been an appreciable risk of getting more than 30 per cent. culls. In making up the final selections, some very poor producers might have been brought back in from this group. On the other hand, if too many had been taken the proportion of definite culls and selections would have been too low: 5 is a good compromise when the culling rate is between 20 and 40 per cent. Above 40 per cent. it should be increased slightly and below 20 per cent. reduced slightly.

TABLE 1

SUGGESTED METHOD OF RECORDING FLEECE WEIGHTS OF SAMPLE RUN

Decimals of Pound	5 lb.	6 lb.	7 lb.	8 lb.	9 lb.	10 lb.
·0	Definite Culls	Definite Culls	/ Probable Culls	Definite Selections	Definite Selections	
·1			//			
·2			Culling Mark / Probable Selections	/		
·3			/	//	/	
·4		/				
·5		//	/	//		
·6			//	/		
·7		/ Probable Culls		/		
·8	/		// Definite Selections	//		
·9		/	////			

Further Trials of the System

When fleece measurement samples are taken on a property, wool weights are recorded on cards—one for each sheep. Eight trial runs were made using sets of these record cards. In each case the cards were shuffled into a random order and a sample was drawn, as in step 3 of the summary of the method already outlined. In step 4 the average fleece weight was guessed without looking at any of the results and in the final step 10 the worst possible choice was always made. For example, if it was necessary to cull some of the probable selections the heaviest cutters in that group were dropped. Even following this conservative procedure the gain from selection was never less than 91 per cent. of that which could have been obtained by using the individual fleece weights. These results are set out in Table 2.

TABLE 2

COMPARISON OF CULLING WITH AND WITHOUT EAR TAGS

Number of Sheep in Flock	Number in Sample	Culling Percentage	Average Fleece Weight of Whole Flock (lb.)	Average of Selections	
				Not Using Tags (lb.)	Using Tags (lb.)
416 . .	50	10%	10·20	10·40	10·41
191 . .	50	10%	8·43	8·64	8·65
280 . .	30	20%	7·34	7·68	7·69
283 . .	30	20%	7·82	8·22	8·26
327 . .	30	30%	9·98	10·46	10·48
244 . .	30	30%	8·60	9·51	9·53
294 . .	30	40%	8·82	10·02	10·04
303 . .	30	40%	11·72	12·60	12·67

Shed Organization

In the average shed two operators will be needed, one to weigh the fleeces and one to brand the sheep. The important point is that there should never be more than one unbranded sheep at a time in any pen. If a card with the stand number on it is picked up with the fleece as it is taken to be weighed there is no risk of confusing sheep in different pens. It may be possible to use a gangway plank resting across the counting-out pens to make for easier branding.

It is desirable, but not essential, that the belly wool be weighed in with the fleece. If it is excluded for some fleeces, it must naturally be excluded for all. It is not essential that all fleece weights be recorded, but this does not involve much extra work and will normally be found worth doing.

If you feel like trying out this method it is suggested you talk over the details with your nearest sheep and wool adviser or husbandry officer. It is probable that he will also be able to arrange the use of a set of the Department's fleece weighing scales.

An alternative method of culling using temporary ear tags was described in the August issue of this journal (page 481). It is suggested that you read it again to see which system would be easier to apply on your property.

The method described in this article is similar to one described by Dun and Restall in the *New South Wales Agricultural Gazette* (April, 1961) and many of their suggestions have been incorporated.

Plate 1: **Flock Ewes in for Shearing at the Department's Toorak Field Station.**

More Milk With Less Effort

By E. B. RICE, Director of Dairying.

Cows have been milked for countless generations in many countries of the world, yet it is only in recent years that serious attention has been given to studying how milk is formed and the mechanism of its let-down. Decreasing manpower in rural districts in the main dairying countries, which has coincided with a trend to larger herds on farms, has led to a marked increase in the use of milking machines. These factors have stimulated researches which have contributed greatly to a better appreciation of the principles which underlie milk secretion and milking methods. The result has been more efficient ways of handling the herd during milking, which ensure more milk being yielded in less time.

Several interrelated factors affect the streamlining and efficiency of milking. They are the milking shed, including the cowyard, the milking machine, the personnel and the milking technique.

The Milking Shed

The conventional walk-through milking bails are efficient for putting through herds up to about 40 cows, but the herringbone shed, which is steadily gaining in use, enables larger herds to be more conveniently and speedily milked and, as it eliminates stooping, it is appreciated by users. Allowing for bailing-up and udder washing, at least nine cows can be milked hourly per set of teatcups. Consequently, the rate of milking of a herd depends largely on the sets of teatcups which each person in the shed can readily handle.

In a herringbone shed each person can handle about 30 cows hourly. The advantage of the herringbone shed is thus really due to the greater numbers of sets of teatcups conveniently handled by each person. The farmer who milks a large herd can expect to save time in a herringbone shed, and milk the cows more easily because he hasn't to stoop, and each time he walks out into the yard he brings more cows into the milking shed than he does with walk-through bails.

The Cowyard

For convenience of milking, cows are brought from the grazing paddock and placed in a cowyard adjacent to the milking shed. A recent development in New Zealand and Victoria is to provide a round cowyard which is fitted with a hinged swinging gate, the length of which equals the radius of the cowyard. Several advantages are claimed for this type compared with a rectangular yard. It is easier to break cows into entering the bails, the swinging gate enables the herd to be kept closer to the bails and so reduces the amount of walking out into the yard to bring cows into the bails, and provided the cows are dehorned they can be packed quite closely in the yard which reduces risk of injury by a rush from an excited animal. Although little interest in round yards has as yet been aroused in Queensland, the favourable comments from users in New Zealand and Victoria suggest round yards should eventually become just as popular here.

The Milking Machine

Nowadays in Queensland, milking machines are used on most farms which depend substantially on dairying. Resulting from the development of equipment which permits the testing of the efficiency of these machines, increasing interest is being shown in maintaining them in efficient condition. Numerous tests made by field officers of the Division of Dairying have shown that much milk may be lost or milking time increased through imperfections in the state of repair or improper adjustment of certain parts of milking machines. Of 2,549 machines checked during the past 3 years, only 198 (or 7·8 per cent.) were found to satisfy in all respects recommended standards for good performance.

The rate and completeness of milking is governed chiefly by the vacuum, pulsation ratio and the tension of the teatcup liners, although the individuality of the cow affects her milking rate. In controlled experiments where other factors were similar, we have found milking rates of cows to average 3 lb. a min.; the lowest cow gave 0·8 lb. and the fastest 7·7 lb. of milk a min.

On request, a field officer will make a free check of the milking machine for any farmer. He is also capable of making minor adjustments which will improve the milking efficiency of the machine, but if major mechanical repairs are needed the farmer must make the necessary arrangements with the distributor of the machine. A full report of the test is made on a form which is left with the farmer.

The Personnel

The persons in the milking shed play an important role. The hormone which controls milk let-down is fully active for only about 6 min. after the cow begins to be stimulated for milking, and so quick milking is essential to get all the available milk from her udder. The training of cows to like being milked is basic to this. Cows should not be excited by rushing them from the grazing paddock to the milking yard, and any unusual noise, dogging or anything which may frighten or disturb the cow in the bails should not be tolerated. Leg ropes can usually be discarded with a trained herd.

In essence, good cowmanship depends on liking cows and treating them quietly and confidently so that they like being milked.

The Milking Technique

The most influential factor in stimulating fast and complete milk let-down is the vigorous washing of the udder, preferably using running water from a fine-nozzle hose. It is fully realised that most Queensland farms haven't enough water to permit this, but available supplies should be used effectively.

The importance of good pre-milking stimulation has been highlighted by experiments in New Zealand. In the first trial there were five sets of identical twins. One twin from each pair had the teatcups placed on as soon as she entered the bails, while the other twin was prepared by hosing her udder with water and rubbing with the hand followed by massage of the teats and lower udder. Squirts of foremilk were drawn from each teat and the cups placed on her 40 sec. after stimulation had begun.

The stimulated group had an average yield of 18 per cent. more butterfat during the lactation period.

All cows were fed, managed and milked in the same way, the only variable being the stimulation of the let-down in the manner mentioned in the one group.

In a further larger-scale experiment in which 13 sets of identical twin cows were used, even more clear-cut results were obtained. The response of the cows in the stimulated group resulted in an average yield of 32 per cent. more butterfat than their non-stimulated mates during the lactation period.

In some countries, hand-stripping of cows after the teatcups are removed has almost completely disappeared, but hand-stripping is still commonly done in Queensland. A survey showed that only about 40 per cent. of Queensland dairymen machine-strip their cows. When hand-stripping is omitted the machine is used to strip by bearing down gently on the teatcup cluster towards the end of milking and hand-massaging the quarters of the udder. Proper pre-milking stimulation of of the cow and a mechanically sound machine are prerequisites to successful machine-stripping.

The many Queensland farmers who have ceased to hand-strip cows after machine milking are fully convinced that it saves time and does not adversely affect the milk or butterfat yields of their cows, their length of lactation period, or predispose them to mastitis, and it is cleaner.

It is clear from research in several countries and in Queensland, as well as from experience in every-day milking shed routine by many farmers, that good milking practices, coupled with a mechanically efficient machine, enable the most milk to be obtained from cows, and save time in the milking shed. As these things are achieved at no extra cost, they can contribute to the cost-reduction objective as a means of improving the economics of dairy farm production.

Grazier Traps Water To Grow Improved Pastures

By R. G. WILSON, Adviser in Agriculture.

Mixed plantings of three buffel grass strains and a method of spreading run-off rainwater have brought improved pastures to low rainfall country north of Quilpie.

This success in the face of unusually dry conditions has been achieved by Mr. L. T. G. Presnell, of "Maybe", 36 miles north of Quilpie.

Commencing with a small "hobby plot" in 1958, Mr. Presnell has now established buffel grass on some 3,000 acres of pushed mulga and gidyea land. Most of the seed has been grown on the property in a specially fenced seed production paddock.

A mixture of Gayndah, Biloela and American buffel grass strains is proving superior to native pastures.

Instead of waiting for the good seasons to aid his buffel grass expansion programme, Mr. Presnell, like a few other district graziers, is taking "short cuts". Run-off storm rainwater is being collected and diverted on to adjacent dry land in an effort to build up soil moisture. The water spreads and soaks into the soil, stimulating native and sown buffel grass pastures into prolonging their growth, nutritive value, density and bulk.

Banks To Spread Water

By using a T.D. 14 "A" dozer and ripper, earth and mulga brush banks from 2 to 3 ft. high and up to 1 mile long are used on a level to very low grade on the flat, drained flooded country to spread run-off water, flood-irrigating the adjacent land.

In his recent first attempt, Mr. Presnell has succeeded in using the run-off water from a 2,000-acre catchment to benefit a 500-acre area, thereby producing good stock feed under prolonged drought conditions when normally it would require a very good season to give the same results.

Improved pasture work on "Maybe" was first initiated in 1958. In view of his steady progress, Mr. Presnell's only regret is that he did not take advantage of the good 1950 to 1956 seasons. Nevertheless, despite an average 9 in. rainfall since 1956, several buffel grass strains have proven their worth, unassisted by fertilizer applications.

All the hardiest perennial and commercially available grasses to date have been tried alone in hobby plots and in mixtures. The Gayndah, American and Biloela types proved superior to the others.

During the last year, good results have followed the water-spreading of a mixture of grasses including the recently available frost hardy Molopo type, the small sweet Birdwood grass, blue and green panics, Rhodes grass and even sorghum almum. The only legume worthy of note on the hard red mulga-turkey bush soil is a species of *Phaseolus*.

Since 1958, Mr. Presnell estimates that established buffel grass is spread over some 3,000 acres of pushed mulga and gidyea country.

Most of the seed used is home-grown in specially fenced seed production and hobby plot areas. Some 5 acres is providing mixed grass seed for further expansion in the pushed mulga country at the moment.

On "Maybe" buffel usually provides a green pick following winter rain, responds quicker, providing more bulk and stands harder grazing than most native grasses. A light grazing in the establishment year usually promotes a stronger crown and induces more seed heads.

Hobby Plots Invaluable

As with a number of other graziers, Mr. Presnell has had his failures, too. His advice is to keep trying. Some of his buffel seeds have lain 12 months in ant-infested mulga country before germinating with timely rains—so "patience" is the key. The cheapest way to assess the various buffel and other grass species is to try a hobby plot. Using 10 oz. each of the various buffel and other grass-legume seeds—dryland or irrigated—on each half chain by 2 chain plot (one-tenth acre), will be found a most interesting hobby from which to note the behaviour, emergence, growth, palatability, seeding ability, fertilizer effect, frost tolerance and so on in relation to each grass on the main soil types of your property.

Also, look into the possibility of using stormwater run-off on your property. It can be another practical means of survival for some of Queensland's driest areas.

Miles Saleyards

A Store Cattle Sale in Progress at Miles. See page 655.

Changing Blady Grass Plains At Tully Into Good Pastures

By F. SWEENEY, Agrostologist.

For more than 30 years, cattle have been fattened at a beast to 20 acres on the blady grass plains of the wet tropics in north Queensland. Management is easy but results are limited to small annual liveweight gains of 5 or 6 lb. to the acre.

Over the last 3 years, Messrs. G. and D. Collins of Echo Plains, near Tully, have replaced much of their blady grass with Guinea grass and centro. Now they fatten a beast to 1½ acres and the annual liveweight gain is 200 to 250 lb. to the acre. That is increasing production forty-fold.

How did they establish this productive pasture?

1. By careful preparation of the seed bed.
2. By planting good seed at the recommended rate.
3. By proper management of the young pasture.

Here are the recommendations for the area:

Cultivate as soon after the wet season as possible—about May or June. This is to bring the blady grass roots up to the surface, where they dry out and die. The longer the drying out period the better the kill. This first cultivation should be 4 to 6 in. deep to expose the whole stem base and main root (Plate 1).

Three or four further cultivations with harrows may be necessary, especially after rain. This prevents regrowth and works the surface into a fine seed bed.

If cultivation is thorough, precropping is unnecessary. On the other hand, poor destruction of the blady grass will demand precropping with cowpeas, extra cultivations the following year, and the loss of a year's grazing.

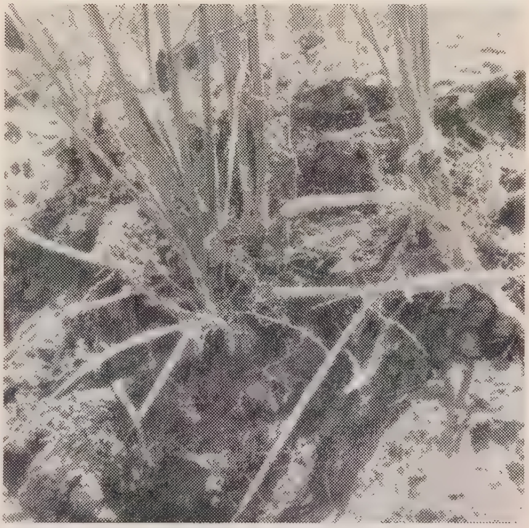


Plate 1. Blady Grass Stem Base and Roots.

Hand-broadcast Guinea grass at 4 lb. to the acre and centro at 4 lb. to the acre. Buy Guinea grass seed early and make sure it complies with the standards set by the Department of Agriculture and Stock. Newly picked Guinea grass seed improves with maturity after storage and the germination percentage increases.

Centro seed should be inoculated before planting. Inoculum and instructions for use are available from seed merchants and other firms. Inoculate seed the night before planting and allow to dry.

Planting time is in late December or January when there is adequate moisture in the soil and follow-up rains are expected.

Guinea grass and centro will not thrive in swampy and poorly drained areas, so plant para grass runners here to exclude weeds.

The use of a simple seeds box attachment on the tractor is better than hand-broadcasting, and when machine planting, seed rates may be reduced to 3 lb. of Guinea grass and 2 lb. of centro to the acre.

One man with a machine planter can prepare seed and sow 30 acres in a 10-hr. day.

Plate 2. Blady Grass Regrowth after Cultivation Too Late in the Season.

Cover the seed lightly or sow at less than half-an-inch deep. A bundle of fence posts dragged behind the tractor gives a good seed cover. Roll the seedbed with a heavy roller to press out air pockets. Recent trials have shown that 4 cwt. of superphosphate to the acre triples the growth of young legumes and grasses, and this means grazing within 6 months.

If correct preparation is carried out and good seed is planted properly, the fast growth by young pasture seedlings will choke out most weeds. Hand-pull the few weeds which do persist, and do not let them seed, because hormone sprays kill centro plants as well as weeds. Bare areas would grow a succession of weeds, so replant these with para cuttings or Guinea grass stools.

The first grazing will be towards the end of the wet when the Guinea grass begins to seed. Graze lightly down to about 12 in. every 4 to 6 weeks and slash stalky material and weeds at about the same height. This will thicken up the pasture and help control weeds.

Grazing should be light in the first year but as soon as the ground cover is complete the pasture may be grazed at from one beast to the acre to a beast to 2 acres and this pasture should be kept down to 6-12 in. for high production.

Good pasture, like cheese, takes time to mature and both should be carefully protected while maturing! Experience elsewhere suggests that within 5 years this pasture could provide a good balanced ration of grass and legume, producing annually 400 lb. of liveweight gain or 200 lb. of beef to the acre. Today that represents beef worth £15 an acre a year.

This represents a huge increase in productivity compared with the current liveweight gains at 6 lb. an acre a year from unimproved land.

It will be seen that practical "know how" is available, but further information is required on such questions as costs, minimum areas for economic soundness, and the co-ordination of such enterprises with the sugar industry.

Common Weeds of Farm and Pasture

by S. L. Everist, B.Sc., Government Botanist.

A handbook that contains brief descriptions of about 110 of the common weeds of Queensland with notes on their distribution and control.

Price to Queensland farmers	5s.
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Available from Department of Agriculture and Stock, Brisbane.

Beef Cattle Diseases In North Queensland

y C. P. CRAVEN, Divisional Veterinary Officer.

A large proportion of the beef cattle used for oth home consumption and export are bred or ttened in North Queensland, where for a number years losses due to various causes have been ccepted as inevitable. In more recent years, wing to the higher prices that the beef industry as enjoyed, there has been more interest in hy losses occur and how they can be prevented. he aim of this article is to put forward reasons or a large number of losses, and discuss these riefly.

attle Tick

The total annual estimated loss to producers Queensland due to cattle tick has been assessed t almost £10,000,000. This does not include raziers' capital costs such as those involved in roviding dipping or spraying facilities. Nor does t include expenditure by State and Commonvealth Departments on tick control. It has been ssessed that 68 per cent. of the beef cattle of Queensland are run within the tick-infested area f the State. As most of northern Queensland attle are in the tick-infested country it is reasonble to assume that a very great proportion of he annual loss occurs in the north.

The loss occurs in a number of ways. Most noticeable to the grazier is loss of condition. Ticks reduce weight gain and milk yield; this in urn necessitates a longer period before "turn off" and poor growth in young stock. Anaemia and eventual death of some stock represents an additional loss of calves, particularly where reeders are concerned.

Drought losses in northern Queensland have been considerable. These are accentuated by the presence of ticks in a herd and could be largely averted if ticks were not present.

Tick fever takes its toll. There have been many losses, particularly in travelling stock. Whilst this can be successfully treated, much valuable time is taken up in doing so.

The cattle tick causes considerable loss in value of hides. It has been estimated that ticky hides are 11 to 35 per cent. less valuable than tick-free hides.

Controlling the tick is expensive. It requires additional capital outlay for the provision of dipping facilities. The regular use of chemicals for treatment is a continuous drain on expenses. Extra labour for mustering and dipping increases the cost of operating a property. Losses can occur during dipping; these include some loss in weight and milk production, accidents, which are more frequent when drought-weakened stock are involved, and poisoning.

The cattle tick is responsible for indirect losses. The cost of marketing ticky cattle in tick-free areas is increased and markets are restricted. Government staff has to be maintained for controlling movement of ticky stock, and staff must be maintained by many organisations for basic research.

There are tremendous obstacles to be overcome before considering eradication of the cattle tick.

In the meantime controlling the tick so that it causes minimum losses should be the aim on all tick-infested properties. There are control measures which can be, and are being, used successfully to keep the tick population down to reasonable limits.

Control is achieved by:

(*a*) The destruction of the tick on the animal.

(*b*) The destruction of the tick on the pasture.

The destruction of the tick on the animal is obtained by thorough wetting of the animal in a spray or dip with a chemical. There are many effective chemicals on the market and research work is continuous in an effort to find better ones. When using chemicals in a dip or spray, remember these must be kept at the strength recommended by the manufacturer. The dip must be thoroughly stirred and best results are obtained by doing this mechanically. Take care to ensure animals are thoroughly wet all over; the best chemical will lose its effect if it does not come into contact with the tick. Thorough wetting of the head and ears is all-important. Try to keep dirt and foreign matter out of dips; this reduces waste of chemical. If some sludge is in the bottom of the dip, stir this up with a shovel thoroughly before dipping.

Spelling a pasture will destroy ticks on it. The engorged female, after dropping from the beast, lays eggs. These later hatch to produce larval ticks. Larval ticks cannot continue their life cycle on pasture alone; they must get on to the beast to develop and propagate. If cattle are kept off the pasture larval ticks must die. Keeping stock off pastures for 3 months in summer or 4 months in winter will ensure destruction of most of the ticks on that pasture.

By a system of rotation of paddocks and proper dipping of cattle before they go into a clean paddock, tick population will be kept to a minimum. There are local differences due to climate and no single routine can be laid down for all Queensland.

Where paddock rotation is practised on properties in northern Queensland, graziers claim considerable success for the system. The number of dippings is reduced, ticks are kept to a minimum and much of the loss due to ticks is recouped. If the system cannot be practised on the whc property, considerable benefit will be derived two or more paddocks are rotated.

Local climate determines considerably the pr pagation of the cattle tick. Tick populatic increases when conditions are hot and humid ar decreases when conditions are dry and col Generally graziers can foretell from this when expect a rise in tick numbers. Strategic dippir makes use of these factors. A series of dipping just before adult tick numbers build up will g a long way towards keeping paddocks fre Generally, frequent dippings following sprin rains will prevent the usual increase in tic population at that time. Also, frequent dipping after the wet season will prevent the build-u which usually occurs in early winter in norther Queensland.

Bovine Contagious Pleuropneumonia

B.C.P.P. is probably the most serious cor tagious disease of cattle that has ever becom established in Australia. It first appeared i Victoria in 1858 and spread rapidly throughou the rest of Australia except Tasmania.

It has been estimated that in the first two year in Queensland, pleuropneumonia was responsibl for the deaths of 4 per cent. of the total cattl population, this representing 160,000 head. B stringent control measures the disease has bee eliminated from all States except Queenslan Northern Territory, and the north of Wes Australia. The greater part of North Queenslan remains infected. The economic loss resulting from the restrictions which have to be impose on stock movements is very considerable and inevitably must remain high until the disease is eradicated. Pleuropneumonia thus interfere considerably with the free movement of cattle both intra and inter State. It closes certain markets in Australia and others can be reache only by what amounts to undergoing a lengthy quarantine period. Some overseas markets are closed to stock from certain parts of Australia, and cattle from other parts admitted only if they can comply with certain conditions, including freedom from the disease on blood test.

As well as limiting markets for Queensland cattle, pleuropneumonia is responsible for the rejection of many forequarters of beef which otherwise would be suitable for the overseas beef market.

Losses by death are seldom spectacular in the endemic areas but amount to an aggregate of £200,000 to £240,000 for the State annually. The total cost to the State has been estimated at £¾ m.

Bovine contagious pleuropneumonia can be controlled in Queensland and eventually eradicated. This is based on the fact that the disease is transmitted only by direct contact between an infected animal and a healthy one. It cannot be transmitted by the many other ways in which other diseases are passed from animal to animal. Healthy cattle can be given immunity to the disease by vaccination. Rigid control of stock movement within the infected area and from this area to clean areas, with vaccination of all such travelling stock, will prevent the spread of disease. Regular vaccination of all herd stock within the infected area will reduce the incidence of the disease in that area. Strict practice of both forms of vaccination will eventually eradicate the disease from this State. By doing this the losses previously due to pleuropneumonia will be eliminated.

Infertility

Calving percentages on properties in North Queensland seem to range between 40 and 90 per cent., with the majority of properties in the lower bracket of this range. An increase in production of course is impossible unless calving percentages are increased. Proper culling cannot be undertaken unless sufficient stock are available and in some cases herd numbers cannot be kept up to normal stocking capacity. Many factors influence the fertility of the breeding herd and some of these are now discussed:

Brucellosis.—This is a disease caused by a germ and usually contracted by the healthy animal eating pasture which has been contaminated by infected afterbirth. In the female animal it causes abortion or the birth of weak or dead calves, cows are difficult to settle, milk production is reduced and it is frequently followed by retained afterbirth.

The disease has not been diagnosed frequently in North Queensland but in the more closely settled southern portion of the State it is a considerable problem. However, it could assume a greater importance in beef herds in the north as more intensive systems of management are developed.

Brucellosis cannot be cured but can be prevented by checking introduced stock for the disease and vaccinating heifer calves with Strain 19.

Vibriosis.—This is caused by a germ which is transmitted by the bull during the act of service. It causes cows to abort their calves, and a number of services are then necessary to settle the infected animals. Sometimes these never settle.

Some properties in North Queensland are extensively infected with vibriosis and there is reason to believe the disease is widespread in beef properties there. Infected animals tend to build up an immunity to reinfection but young stock breeding for the first time to an infected bull are highly susceptible.

Control is very difficult under intensive systems of grazing. However, bulls which have been unmated are clean, unmated heifers are clean and cows which have had a normal calf followed by 3 months away from service can also be considered clean. On this basis a two-herd system could be maintained. One herd would consist of clean stock, the other herd would consist of infected stock. As cows calved normally and had the 3 months' sexual rest they could then be transferred from the infected to the clean herd. Of course, previously unmated bulls or bulls which are known to have served only clean stock should be used in the clean herd. Infected bulls could be used in the infected herd. Bulls do not show the same tendency to natural recovery as do females, and repeated treatment with antibiotics is necessary to clean an infected bull.

Leptospirosis.—This is a disease caused by a germ and picked up from pasture which has been contaminated by the urine of an infected animal. It causes fever in adult stock and if females are heavy in calf the high fever is frequently responsible for cows aborting. It causes death in calves and can reduce the calf population considerably.

Leptospirosis is common along the northern coast and is known to occur in beef cattle inland. It may be responsible for abortions. The disease can be treated successfully with modern antibiotics. Effective vaccines are available for protection.

Trichmoniasis.—This disease has not been diagnosed in North Queensland. It has caused considerable trouble on some properties in the south. Its effects are very similar to those of vibriosis.

Miscellaneous.—Non-infective conditions of the breeding organs of the female caused by a variety of germs have been found responsible for many cases of infertility. Ovarian abnormalities and injuries have caused other cases. Defects and injuries in the bull have also been responsible for poor calving figures.

Environmental Causes.—In practically all areas of north Queensland, cattle are subject to temperature stress in summer and nutritional stress in winter. There is evidence that the high temperatures to which bulls introduced from the southern parts of the State are exposed to in the north are responsible for a lowering of their fertility. Infertility is temporary and once acclimatised these bulls are quite fertile. When bulls are bred under these hot conditions, apparently the high temperature has no adverse affect.

In North Queensland during the drier part of the year natural feed is very poor. The female animal, unless fed with supplements and particularly if suckling a calf is thus subject to undue stress. In an effort to overcome this stress she frequently will fail to breed. Once the stress is removed and adequate feed is available, breeding will continue. Thus many cows will produce calves only every 2 years or more, depending on the seasons. This can only be overcome by keeping breeding females on an adequate plane of nutrition.

Tuberculosis

Records indicate that tuberculosis is widely spread in the beef herds in North Queensland. Of all cattle slaughtered at Townsville and Bowen during the years 1954 to 1957 inclusive, 1 to 2 per cent. were shown to be affected with tuberculosis. During this period 2,380 carcases were totally condemned. Some herds in North Queensland have very little tuberculosis whilst the incidence in others is very high.

Control of tuberculosis, of course, is obtained by testing for the disease in herds and slaughtering animals found positive to the test. There are tremendous practical difficulties involved in undertaking such tests on a State-wide basis. However, attempts are being made to prevent the spread of the disease by encouraging stud herds to be tested.

Buffalo Fly

The buffalo fly was first noticed in Queensla
during the wet season, 1927–28. After f
appearing in north-west Queensland, it gradua
spread in a south-easterly direction till in 19
it was observed as far south as Dalby. T
advance or regression of the fly was larg
determined by the type of season, although
spraying of travelling cattle limited its spre
below Gympie.

When cattle are initially attacked by buffa
fly it causes considerable damage. The irritati
produced by the regular bites of many fl
reduces grazing time, resulting in loss of con
tion or their fattening is delayed. As anima
become accustomed to them they are less worri
and the effects are less conspicuous. Neverth
less in some parts of the Gulf Country whe
control measures cannot easily be undertake
stockowners regard the fly as a serious pest a
one that causes as much worry to stock as do
the cattle tick. There is no doubt that in th
area the growth and wellbeing of cattle a
considerably retarded by the fly. Because of t
sores which the fly is capable of initiating, the
can be considerable hide damage. With the wid
spread use of the more modern chemicals, pa
ticularly DDT, in cattle dips and sprays, t
effects of the buffalo fly have been reduced co
siderably. However, where treatment with su
chemicals is not practised regularly as in t
Gulf Country, or in wetter areas where catt
cannot be mustered for treatment, some oth
means of applying the chemical to cattle shou
be found. For this purpose back-rubbers soake
with DDT can be used. These consist of
length of barbed wire twisted around four strand
of No. 8 fencing wire. Bags are then wrappe
around this and tied at intervals with tie wire
This is then suspended between two trees o
posts approximately 16 ft. apart so that th
middle is about 18 in. from the ground.

A 20 per cent. solution of DDT is availabl
on the market for use with back-rubbers. On
part of this solution is mixed with three part
of fuel oil and this mixture is poured on th
back-rubber to thoroughly saturate it. Eac
back-rubber will absorb approximately 1 gal. o
the mixture and will service 50 to 100 head o
cattle. Rain will not affect the mixture. Eac
rubber should be recharged every 2 to 4 weeks
depending on use. If back-rubbers are place

where cattle normally congregate it will be found that animals will gradually use them for scratching.

Mineral Deficiency

Large areas of country in North Queensland are deficient in phosphate. These areas include most of the coastal country apart from a few fertile river valleys, an area west of and including the Atherton Tableland, the Charters Towers area including country in the Cape and Campaspe Rivers watershed and on the Dividing Range at Pentland, north of Julia Creek, the watershed of the Saxby and Norman Rivers, and west of Mt. Isa. Marginal deficiencies occur in many other northern areas.

The phosphate content of a pasture is at its peak when the pasture is actually growing, and falls off rapidly as the pasture matures. In some areas outlined, the phosphate content of the pasture is never adequate for stock, in others it is adequate only during lush growth of pastures.

Animals not receiving sufficient phosphate will grow slowly and imperfectly and are unable to withstand drought conditions. Reproductive efficiency may be impaired and when available phosphate is extremely low, "peg leg" can result. Animals with "peg leg" cannot forage for available food and deaths from accident can result.

Phosphate deficiency can be overcome by giving phosphate to the animal. There are many products available, such as bonemeal and boneflour. Under extensive conditions of grazing the most practical method is to place the phosphate in special troughs. A mixture of half salt and half bonemeal placed at suitable points in the paddock will enable a large proportion of the herd to get adequate phosphate.

Another mineral considered to be commonly deficient in North Queensland is copper. This mineral is apparently lacking in large areas of coastal country. On copper-deficient country animals canot make full use of the feed available even though this appears adequate. This results in a setback in growth which normally should be obtained on such pastures.

A response to treatment of copper deficient animals has been obtained by injection of copper. Copper gylcinate injected under the skin at intervals of 3 months has provided animals with sufficient copper which was not available in the pasture.

Treatment of copper deficiency is much more complicated than that of phosphorus. Although the effect of copper treatment is sometimes spectacular, in other areas it is most disappointing. Sulphate and molybdenum are complicating factors.

Ephemeral Fever (Three-day Sickness)

The first appearance of ephemeral fever in Australia is thought to have been in 1936. During this year it spread rapidly throughout Queensland from north to south. Most animals in Queensland were affected. Milder outbreaks occurred in 1940 and 1946 and a more severe outbreak in 1956. Since then, isolated mild cases have occurred in northern Queensland.

The disease can cause a loss in production of milking females; it interferes considerably with the movement of fat stock to market, and bulls sometimes are severely affected. There is no specific method of control but interfering with stock as little as possible during the course of the illness will reduce loss to a minimum.

Winter Dysentery

Winter dysentery was first reported in Queensland in 1958. It spread rapidly northwards from the southern part of the State. It was highly infectious and characterised by a profuse diarrhoea which sometimes contained blood. Deaths were very few but in an infected herd most of the cattle would have the disease. Individual animals were affected for only a few days. Loss consisted of a falling off in milk production in breeders and decrease of weight in fattening stock. If feed was poor the effects of the disease would be more serious. While outbreaks occurred throughout the grazing country, its main incidence was in areas of closer settlement.

Isolated outbreaks of a milder nature have been reported in certain areas of north Queensland since 1958. There is at present no known control for winter dysentery.

Blackleg

This disease appears to strike in epidemic form periodically. In between epidemics isolated cases do occur. The causative germ is in the soil. Usually animals between the ages of 6 months and 2 years are found dead. A diagnostic feature is the cracking feeling obtained when the skin of the carcass is pressed. In epidemic form losses of animals in the susceptible age group can be considered.

Control can be obtained by vaccination.

Heat Stroke

In North Queensland, cattle can be subjected to high temperatures and high humidity. Any excessive movement under such conditions causes body heat of cattle to build up rapidly. Cattle do not have an efficient mechanism for disposing of excessive heat. If adequate precautions are not taken to keep cattle cool during routine station practices, losses can be heavy. It appears the effects of overheating can be cumulative and once overheated, a long period of rest must be given before animals return to normal. If sufficient rest is not allowed and animals become hot again, death will quickly follow.

Once the temperature rises to a certain point, irreversible changes occur and subsequent resting will not save the animal.

Overheating can be avoided by handling cattle (if they have to be handled) in the cool part of the day, moving them slowly and quietly, providing shade in yards, allowing ample time to cover a particular journey, and avoiding overcrowding in small yards. Of course, particular care must be taken with fat animals. Hot animals should not be allowed an excess of water; this appears to further impair the body mechanism responsible for losing heat.

Worms

Under the extensive system of grazing as practised in the greater part of North Queensland, it would not be expected that animals would pick up heavy worm burdens. However, it must be remembered that as temporary waterholes dry up, cattle congregate on the more permanent water and sweeter areas of pasture. Under these circumstances heavy worm burdens can be picked up. Of course wormy animals, particularly young stock going into a dry season, have less chance of survivial.

Drenching with the efficient drugs now on the market will reduce worm burdens to a minimum. Treatment of young stock should be done following the wet season before feed becomes poor. Worms will not survive on a spelled pasture. Treated stock put into a paddock which has been spelled for a month have a far better chance of surviving a lean period. Larvae of cattle parasites tend to congregate in the dung pads, where drying out is slow, and are released after heavy rain.

Poisons

Of the metallic poisons, arsenic compounds still remain the most frequent killer. Utmost care should be used when dipping cattle in arsenic. Disposal of used drums out of reach of stock is essential and if using arsenic weed-killer keep stock well away from the poisoned area at least until the next rain.

Poison plants in North Queensland are responsible for many losses. Noogoora burr can be very dangerous. This comes up along creek banks and gullies following rain and floods. The small two-leaved plant is the stage of growth that is dangerous. When this appears it is wise to remove cattle from the area until the plant has reached a more mature stage.

Lantana has caused many losses. Both types can be poisonous. When hungry stock are not accustomed to eating it, many can be affected.

Heartleaf is dangerous, particularly following a burn. It usually grows in the poorer type country and when feed becomes scarce in heartleaf country stock should be moved to better country to avoid losses.

Poison gidyea is responsible for many deaths, particularly in the area of the Georgina River.

Oleander cuttings from gardens around homesteads have caused deaths when left where stock can get to them.

Yellow daisy has been responsible for heavy losses in travelling stock. Such stock should be taken as quickly as possible through an area where yellow daisy is growing prolifically.

Zamia and grasstree, when eaten by cattle, have severe effects.

Poison plants cover many square miles in North Queensland. Eradication of these on large properties is difficult and expensive. To keep losses at a minimum, graziers should be able to recognise the more dangerous types. If moving hungry cattle through areas known to contain such plants, keep the animals moving and so prevent them from picking up sufficient to cause trouble. When cattle are paddocked in poison areas the poison plants will be left alone whilst there is ample grass. However, if feed becomes scarce and cattle are searching they will eat sufficient poison to cause harm. Move these cattle to more reliable areas, even though supplementary feeding may be necessary.

The problems discussed have occurred, some frequently, others not so frequently, on properties in northern Queensland. Further details concerning anything discussed can be obtained from the Department of Agriculture and Stock.

Convenient Plot Marker

Positive marking of plot boundaries is essential in experimental work.

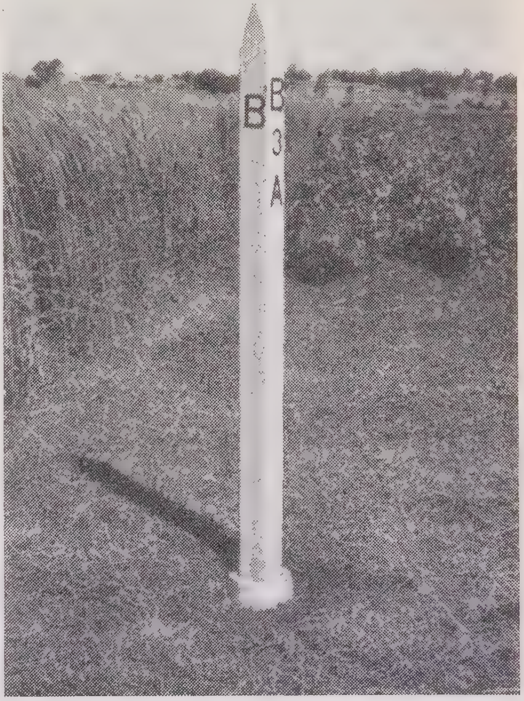
Permanent posts sunk into the ground interfere with the passage of implements and become unsightly unless given regular attention for weed control. Systems involving measurements from fixed points are labour-consuming and contain an element of error.

The accompanying photograph illustrates a useful method in use at the Gatton Regional Experiment Station. An 18 in. length of old 4 in. diameter fibrolite pipe is sunk into the ground to surface level. The marker post comprises a piece of 4 in. x 2 in. hardwood with corners trimmed to fit snugly into the pipe. The post is neat. It is simply lifted out of the way as required to permit the passage of implements and then returned to place. The position is definitely fixed and easily found.

In the photograph the top couple of inches of soil were removed to show the concrete pipe. The post shown was turned slightly for the sake of the photo. On the front it indicates "B" Block and together with its counterpart in the background defines the boundary between plot B3A on the right growing potatoes and plot B2B (this is painted on the opposite side) on the left growing wheat.

A similar system is used for identification of rows in the orchard. A short length of old wornout irrigation pipe can be substituted for the fibrolite pipe shown in the illustration.

—*C. A. Schroder, Assistant Irrigationist.*



San José Scale On Deciduous Fruits

By **M. BENGSTON, Entomologist.**

Winter oils provide a good control of San José scale on deciduous fruits.

More than a dozen species of scale insects are associated with deciduous fruits in Queensland. Of these, San José scale, *Quadraspidiotus perniciosus* (Comst.), gives most concern to fruit growers. This pest has risen in importance in recent years due to two factors: (*a*) an increase in pest numbers, and (*b*) a rejection of affected fruit by the export market.

San José scale entered Australia during the latter part of last century and soon spread to deciduous fruit growing districts. Its presence on the Darling Downs and in the Stanthorpe district in Queensland was recorded in 1895.

The occurrence of this pest in Australia was considered of major importance and in the early part of the present century was discussed at conferences of State entomologists. Inspectors were assigned to the areas concerned in Queensland and the insect was found to be so widespread that eradication was not possible. Attention was concentrated on evolving a commercial control.

San José scale now occurs in most fruit-growing districts of the State. In the Stanthorpe district, the main area of deciduous fruit production, the insect has been well controlled over many years by routine winter oil sprays. In recent years, however, the widespread use of the newer insecticides and miticides, and the movement away from the winter oil sprays, have been accompanied by an increase in pest numbers. The importance of this is emphasised by the demands of our export markets for clean fruit.

The pinhead sized scales are of a dark greyish or greyish-brown colour, and cover the soft yellowish body of the insect.

The insect feeds by sucking from the tissues of leaves, fruit and particularly twigs.

Heavily infested bark has a scurfy appearance and under these conditions spurs, leaders or whole trees may suffer serious set-back or may even be killed.

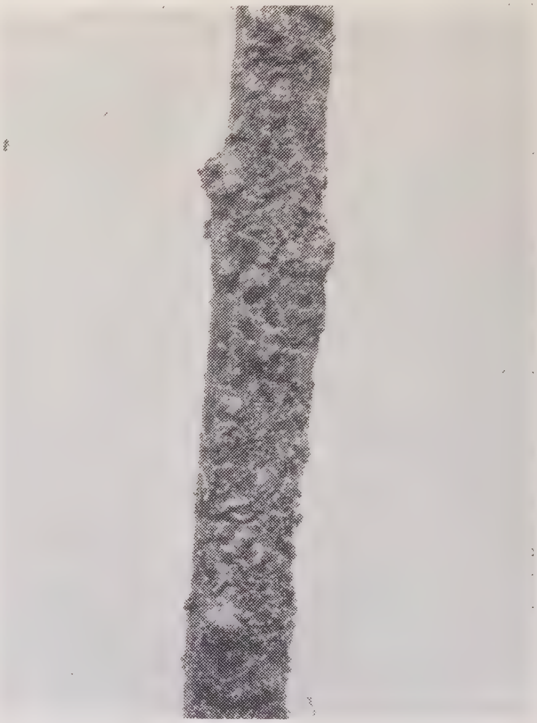


Plate 1

An Apple Twig Heavily Infested by San José Scale.

Stone fruits typically exude gum from affected bark.

Fruit symptoms are particularly noticeable as reddish spots which develop on the skin around feeding punctures. These spots are conspicuous on light-coloured varieties of fruits. On the dark varieties the reddish colour develops prematurely and finally the fruit has a mottled appearance.

In orchards, infestations start on individual trees or small groups of trees. Dispersal is governed to some extent by spraying practices. When applications are not thorough, for instance, the pest remains in blind spots. From these spots, young insects spread over established trees at a time when orchard work is heavy and also when control is less efficient. The result is typical spur or leader dieback. In young plantings, occasional trees or groups of trees are either badly damaged or killed, and replacements are required.

Winter oils provide a good control of San José scale. These may be either superior oil (3 gal. in 100 gal. water) or dormant oil (5 gal. in 100) while the trees are fully dormant, or superior oil (3 gal. in 100) or semi-dormant oil (5 gal. in 100) applied at the green tip stage. Spraying must be sufficiently thorough to eliminate blind spots.

These oil sprays do not interfere with the numerous natural enemies of San José scale. They do, however, control mites which overwinter on the trees.

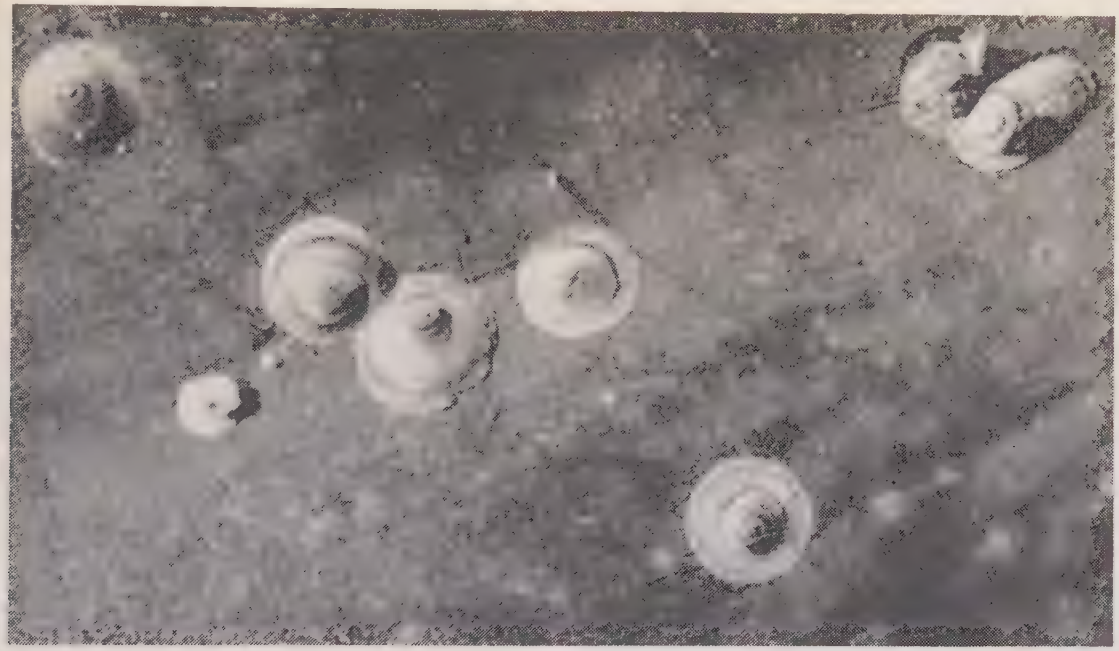


Plate 2

San José Scale (enlarged) on a Plum.

Botany For Farmers

Although compiled in the first place for beekeepers, "The Honey Flora of South-Eastern Queensland" has a use for farmers and others interested in botany. It contains illustrations and descriptions of the important ironbarks, gums, bloodwoods, boxes, stringybarks, wattles, tea-trees, and cultivated plants such as lucerne, pumpkins, oranges and clover.

"The Honey Flora of South-Eastern Queensland" contains 199 pages and 178 illustrations. Prices are: In Queensland 15s. a copy, with a 3s. discount to registered apiarists, University botany students and booksellers; elsewhere £1 a copy.

Hybrid Sorghum Trials At Biloela

By **P. J. C. BRAUNS, Assistant Experimentalist.**

For two consecutive seasons, grain sorghum hybrids have now been grown in trials on the Biloela Regional Experiment Station. The hybrid material was based on material supplied by Mr. R. F. Moore, Plant Breeder, Hermitage Regional Experiment Station, as a result of his Queensland work and from material obtained from American sources. The standard grain sorghum variety Alpha, was included as a comparison in both seasons.

The trials were grown on a fertile clay loam. The year 1959-60 was an average season in all respects, while the 1960-61 season was a dry one, with below average rainfall—a season in which the sorghum suffered from moisture stress.

Of the 12 hybrids so far tested, 5 are outstanding in performance, yielding better than the trial average, while 3 others are promising, yielding higher than Alpha.

The two most promising hybrids so far are Texas 610 and Texas 630 which yielded 38 per cent. and 31 per cent. respectively better than Alpha during the two seasons.

Some of the outstanding features of the hybrids were:—

1. The seed is much bigger—up to 3 times the size of Alpha. To obtain the same strike, therefore, planter settings will have to be at a much heavier rate than for Alpha.
2. The hybrids are faster growing and quicker to mature than Alpha. In both trials the hybrids reached heading 7-10 days earlier than Alpha.
3. All hybrids are taller than Alpha, but no inconvenience with harvesting or lodging has, as yet, been experienced.
4. The hybrids are susceptible to the sam diseases and pests as Alpha.
5. Texas 630 merits special mention becaus it is a white seeded variety while all othe hybrids possess the usual brown seec colour. Feeding trials have shown tha the white sorghum seed is more palatabl than brown seed.

The following table shows the results from the 12 hybrids grown in the two seasons:—

TABLE 1

Variety or Hybrid	Yield in Bus. per acre		Per Cen Increase over Alpha
	1959–60 season	1960–61 season	
	Bus.	Bus.	%
Texas 610	61	38	38
Texas 630	51	43	31
Texas 660	50	40	25
Texas 601	46	..	..
Texas 620	39	36	4
Texas 608	..	33	..
Texas 611	..	30	..
Texas 590	..	19	..
Martin x Caprock	56	..	..
Martin x Alpha	55	27	14
Martin x Redbine–60 ..	..	18	..
Combine Kafir x Alpha ..	51	34	18
Alpha	37	35	..
Average	48	32	..

Generally speaking, the sorghum hybrid trials so far show that some hybrids outyield the standard varieties to such an extent that they appear to have a promising future.

Texas 610 and 630 have so far been the best hybrids at Biloela Regional Experiment Station.

Pests Of Bowling Greens

By B. R. CHAMP, Research Entomologist.

The high-class surfaces required on bowling greens raise the status of some pests which elsewhere are of little consequence. Those which may be of concern under the specialised conditions encountered are the couch grass mite, the felted grass coccid, the grass caterpillar, cutworms and armyworms, black beetle and other white grubs, mole crickets, ants, snails, and earthworms.

Couch grass mite.—Infestations of couch grass mite are confined to green or Indian couch grass and have not been recorded from Queensland blue couch. Bowling greens of green couch grass are found mainly in western districts, where dry conditions prevail.

The first indication of mite damage is the appearance of small brownish patches in the sward. The terminals of affected grass have a bunched appearance and the leaves are short and spine-like. On closer examination, colonies of the mite may be seen as minute scarlet spots under the ensheathing leaf bases.

Felted grass coccid.—The felted grass coccid can attack a wide range of grasses but bowling green infestations are confined usually to the edges of grassed areas. Where severe outbreaks occur, the grass wilts and turns brown. When the grass stems and roots are examined, the insects with their white, felt-like coverings are easily seen.

Grass caterpillar.—During late summer and autumn the grass caterpillar sometimes attacks bowling greens in large numbers. The caterpillars, which grow to a length of one and a-quarter inches, feed at night on the flag of the grass, leaving only the stems. The first indication of damage is usually a browning caused by loss of the green leaf cover. A close inspection reveals the presence of the greyish-green translucent caterpillars and denuded grass stalks, while the ground beneath the sward is littered with the pellet-like excreta of the insects. The grass caterpillar is the larva of a light greyish-brown moth measuring about 1 in. across the outstretched wings. Large numbers of these moths are attracted to artificial light and may create a nuisance during the evening in unscreened clubhouses.

Cutworms and armyworms.—Under exceptional conditions cutworms and armyworms may be present in bowling greens and cause noticeable damage. Usually they occur as isolated individuals and their activities are not apparent. Cutworms and armyworms are caterpillars of large stout-bodied moths which measure about three-quarters of an inch in length. The caterpillars, which grow to one and a-half inches in length, feed at night on the flag of the grass and cause damage similar to that of the grass caterpillar. Cutworms may be distinguished from armyworms by their dark greasy appearance and habit of curling up when disturbed.

Black beetle and other white grubs.—White grubs are the larval stages of a number of stout-bodied black or brown beetles from half an inch to 1 in. in length. The grubs rarely cause damage of any consequence to bowling greens but the adults when emerging from the ground can affect the bowling surface by leaving small piles of earth near emergence holes. At times of peak emergence the green may be littered with beetles, crawling and dead.

Mole crickets.—Mole crickets are brown insects about one and a-half inches in length which have broad shovel-shaped forelegs adapted for burrowing. They tunnel just below the surface of the soil and disturb the roots. These activities result in uprooted grass and uneven playing surfaces.

Ants.—Occasionally ant infestations occur in bowling greens. Usually, however, normal mowing, rolling and watering operations are sufficient to discourage their activities.

Snails.—Snails sometimes appear on greens, leaving silvery slime trails. These trails are of no consequence but the shells, if not removed, can be a nuisance.

Earthworms.—Earthworms are normal inhabitants of bowling greens and other grass swards. When populations are high the playing surface can be affected by the small heaps of earth left from their burrowing activities and by the worms themselves.

Control

To control pests of bowling greens with the exception of the couch grass mite and felted grass coccid, spray with dieldrin 0·05 per cent. at the rate of 1 gal. of spray per 500 sq. ft. of turf, and follow with a light watering. If ants become troublesome, increase the concentration of dieldrin to 0·1 per cent. This material will kill the pests involved, and bring them to the surface. Removal may be necessary to preserve a true playing surface.

During times of caterpillar outbreaks, early warning of attack is obtained by laying wet bags overnight on the sward and examining them early next morning. Any caterpillars present will be found clinging to the bag or to the top surface of the grass immediately beneath.

Control the grass mite by fumigating with carbon bisulphide. Cover affected areas with a tarpaulin or similar gas-tight cover raised c boxes or framework sloping to about 3 in. abov the ground, and seal the edges by weighting ther to the ground. On shallow dishes, place piece of cloth saturated with carbon bisulphide at th rate of 1 oz. to 15 c. ft. of enclosed space, an leave the covers in place for 3 hours. Thi treatment will kill the felted grass coccid alsc but if the felted grass coccid is present alone spray with nicotine sulphate (1 in 480) anc white oil (1 in 40) at the rate of 1 gal. of spray per 500 sq. ft. of turf, and as with dieldrin follow with a light watering.

Warnings

Dieldrin and nicotine sulphate are poisonous, and operators must wear freshly-laundered protective clothing while spraying. Particular care must be taken when diluting the concentrates and all utensils must be cleaned thoroughly after use.

Carbon bisulphide is highly inflammable and explosive in air mixtures. Fumigation must not be carried out near naked lights, electric switch gear, or hot water pipes, and suitable warning notices must be posted.

Scientific Names—Pests

Ants	*Formicidae*
Black beetle	*Heteronychus sanctae-helenae* Blanch.
Couch grass mite . .	*Dolichotetranychus australianus* (Womersley)
Cutworms and army-worms	*Agrotidae*
Earthworms	*Pheretima* sp.
Felted grass coccid . .	*Antonina indica* Green
Grass caterpillar . .	*Psara licarsisalis* (Walk.)
Mole crickets	*Gryllotalpa* spp.
Snails	*Helix* sp.
White grubs	*Melolonthidae*

Grasses

Couch	*Cynodon dactylon* (L.) Pers.
Queensland blue couch	*Digitaria didactyla* Willd.

Tobacco Growing In Queensland

Queensland tobacco growers may obtain free of cost an up-to-date book on tobacco growing in Queensland.

This book contains four main sections prepared by various specialist authors. The first section covers the growing of the crop, curing and preparation for market, while the others covers diseases and their control, pests and their control, marketing and customs and excise regulations.

The book is well illustrated, several pages of colour photographs being included in addition to the usual black and white illustrations.

To obtain this book free of cost it is only necessary for a tobacco grower anywhere in Queensland to register with the Department of Agriculture and Stock. This registration is normally required each year under the regulations of the Tobacco Industry Protection Act, and forms can be obtained from Departmental officers in all tobacco growing areas, or from the Department of Agriculture and Stock, William Street, Brisbane.

Presents With A Future

Yes, it's Christmas again—or very nearly. Anyway, gift lists and shopping cannot be put off much longer.

If you've been listening to the casual remarks of family and friends with your gift list in mind you've probably already started shopping.

For the blanks that are still there the following reminders from Miss Nancy Foskett, Senior Extension Officer, Women's Service, New South Wales Department of Agriculture, may help you solve some of your problems.

Gifts that continue to please through the year, or years, are appreciated long after 25th December. They include:—

Swimming lessons for the youngsters—or anyone who can't swim!

A really comfortable chair for in or outdoors.

A low table to go with the chair you gave last year.

Shrubs, trees, indoor plants (with instructions for watering, fertilising, if it's an unknown or unusual variety).

A shower recess in the laundry.

A standard, table or bed lamp; or outdoor lighting.

A set of bookshelves.

Small steps to make the top shelf safer and easier to reach.

Subscription to magazine, library, book club, or record club.

Fabric for new curtains.

A backrest for the car—or a portable ice box.

A baby toolchest for mother—hammer, pliers, screw-driver, nails and screws.

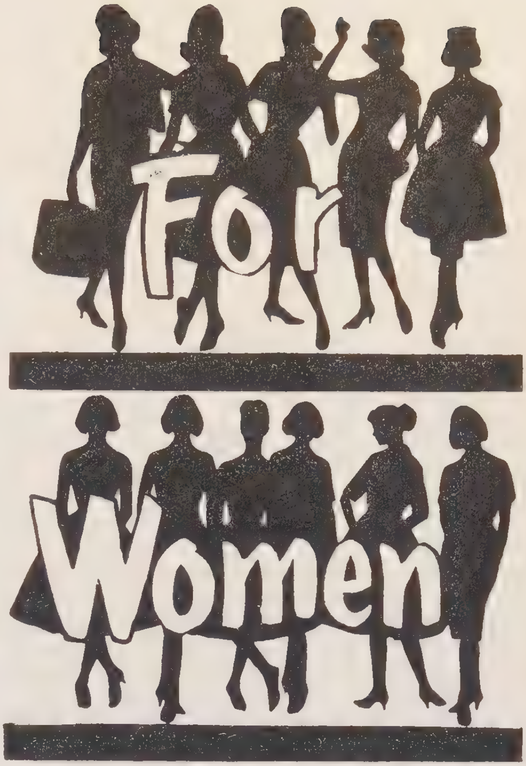
A twice, thrice or half a dozen times a year paid for appointment with the chiropodist, or for a facial.

A promissory note for the painting of the kitchen.

A prepaid and promised baby-sitter for certain specified days throughout the next month or so.

A set of really sharp knives.

A lampshade.



Meals Along the Road

Whether you move from motel to motel, hotel to hotel, or one overnight camp to another, cooking along the way, instead of patronising restaurants and roadside eating places, is preferred by many holiday makers.

If this is your idea of the ideal holiday you'll know that thorough planning and packing before you leave home is essential if out-of-doors cooking is to be as pleasant as out-of-doors eating. Over the years you'll have collected all those things which make this possible—and, in many cases, they're all clean and packed away waiting for the next holiday.

With this occasion not far off for many families, here are some of the things it's worth checking on:—

Take as little cooking gear as possible, but be sure you have enough to make cooking easy. Plan "easy-to-prepare-with-the-least-equipment meals" before you leave home.

For meals-in-a-hurry and for "no outdoor fire" periods carry one of the many compact outdoor cookers now available.

Don't forget the sturdy hinge griller.

Lacking the stones to build a fireplace, dig a pit for the fire; making it a little smaller than the area of the griller. If you've taken the precaution to buy the griller large enough and strong enough to leave room for the billy and the pan, after the full complement of chops and sausages have been packed in, then the whole lot can be over the fire at the one time.

The pit makes a good place to dispose of all rubbish before you fill it in again—be sure to make it level so those coming after don't run the risk of a twisted or broken ankle.

A supply of large paper bags—one for each day—will take care of fruit peelings, used tissues, and other rubbish while travelling. They can be burnt in the next fire or placed in the rubbish container at the next garage or camping area.

If you haven't yet replaced the "tin-dish" you use for washing-up with one, or two, of the semi-soft plastic variety, see what Father Christmas can do for the family camping gear!

If he's specially generous the Old Gentleman may be coaxed to include one of the large, insulated food containers—good for hot or cold foods.

For families whose holidays are mostly the camping type a portable icebox is a worthwhile investment.

While it's good to have a variety of tinned goods, don't forget they can be bought as you go, thus saving space and weight. This way, too, you're more likely to try something new and different—somehow we're generally more venturesome on holidays.

Planned Parties Are Best

Everyone knows well enough that planning contributes towards the success of any activity—be it work or play.

When it comes to entertaining, whether for 2 or 22, planning ahead pays in extra enjoyment not only for your guests, but for you, too. And, when it's a family party knowing beforehand who has which responsibility will mean that all the jobs are done—not some done twice and other not at all!

For those who like to check up on what to do, where to begin and how to plan, here is a list of some of the things which go towards enjoying your own family party.

Have a family discussion to decide on a date which suits everyone—in this way co-operation is given more willingly.

Don't plan to serve a great variety of food, and don't be too fancy. Let one fancy dish—or cake—satisfy your urge to have something new or different (of course you'll have tried it out beforehand). Here, too, perhaps some of the cooking can be taken off Mother's shoulders. How about a "flag" to tell the guests "Jane made these" and "This is Kate's cake"?—And "Pete's punch" will probably taste a lot better than fruit cup! (Good for Pete's ego, too—and future help on the home front!)

Invite as many guests as you can cope with comfortably and conveniently. Be sure every member of the family has some guests at the party and try to include any newcomers to the district.

These days informality is enjoyed by everyone, but don't be casual.

Have a programme for the evening—don't just leave it to chance. No need to have a copy in your hand—far better if your guests are unaware of any deliberate planning on your parts.

After the Party

When talking over the party have each member of the family consider these questions:

Were our guests greeted warmly?

Did I find time to talk with each guest for a few minutes?

Did I make sure everyone was introduced?

Did I help conversations along by introducing a topic I knew was of interest to more than one member of a group?

Did I watch to see that the newcomers were not left out?

Was I tactful? Did I manage to break Betty's monopolising of the conversation without hurting her feelings?

Did I thank those who helped me?

When guests talked to me did I give them my whole attention—or did I let my mind, and eyes, wander away while I said an occasional "yes" or "no" (and probably in the wrong place)?

Did I tell departing guests how much we enjoyed their company?

Trip Tips

Everyone has his lists of what he needs for this, that or the other type of holiday. Sometimes they seem endless but, nevertheless, if preparation, packing and the trip are to be smooth and enjoyable, systematic lists, planning and packing go a long way to ensuring a good holiday from start to finish.

Individual and family lists will vary, but there are some things we may have overlooked:

If camping out it is wise to stop early enough to be organised before dark and to stock up with supplies.

Warning lanterns to set fore and aft of the car in case of trouble at night will take space but could save your life.

Insect repellent for personal application, and spray for the camp-site, picnic spot or room are essential for summer holidaying.

Include anti-sunburn lotion or cream in the first-aid kit as well as something for sunburn treatment.

Take at least one good flashlight—there is a square cased one on the market which won't roll away; and a lantern for camping areas "away from the crowd" and so probably not supplied with power.

Keep several large carry bags handy inside the car for holding rubbish.

Take a minimum of toys and games equipment, but enough interesting ones, to keep small children happy.

Even if it is to be a beach holiday, a pair of strong shoes are often needed.

A good, gallon thermos jug is a must for supplying cool, refreshing water while travelling—don't forget to put some ice-cubes into it.

By now everyone is well aware of the many uses and advantages of plastic bags—but take twice as many as you think you'll need—and include some large enough to take coats, rugs and bedding.

A clip-on plastic lining for rugs means they can be used on the ground by day and the bed by night.

As post offices never seem to be open when you're there, buy lettercards and stamps for postcards before you set out.

Select Fabric to Reduce Sewing Time

Irrespective of whether you like to make your own clothes, or not, the time in which to do so is not always available.

One way of cutting down on the time required is to select the material with this fact in mind, and on this aspect of home dressmaking, Miss Nancy Foskett, Senior Extension Officer (Women's Service), New South Wales Department of Agriculture, has this to say:

Firm and closely woven fabrics are easy to cut out, and can often take a finger crease which reduces trips to the ironing board. Many firm, closely woven fabrics do not fray and seams need less finishing.

Plain colours, all-over prints or *small* woven checks or stripes are quicker to cut out and put together than larger plaids or stripes that need so much time when cutting and putting together to ensure matching of stripe or check.

Plain or all-over designs are better than one way designs as less time is required to lay out pattern pieces.

Avoid—

Slippery fabrics which take longer to cut out because they twist and slip, and need more careful basting to ensure accurate final stitching.

Loosely woven fabrics on which more time has to be spent in seam finishing to prevent fraying.

Materials which are hard to sew, to handle and to press such as the very closely woven ones which are harsh and stiff; some with finishes through which it is difficult to push the needle; some of the newer synthetics which require special care of one kind or another; and also pile fabrics which need careful tacking to prevent the fabric slipping as it is being stitched.

Material that requires straightening before cutting.

Material that requires pre-shrinking.

Removing Spots

Enthusiastic spring-cleaners will probably have come across some spots on furniture and fabric that have escaped their notice during the past winter months.

These may be on woodwork, walls, furnishings, or luncheon cloths.

The following methods of removal should help you get rid of them:

White spots caused by moisture which have eluded general scrutiny should respond to the following treatment—

First remove the furniture wax by rubbing the spot with a cloth and warm water, with a little turpentine added if paste wax was used to polish.

Then, put linseed oil or oil of wintergreen on a clean cloth and rub lightly with the grain of the wood—rubbing beyond the white spot.

If the finish becomes sticky, stop rubbing; wait until it is dry, and if the white spot has not been removed, repeat the oil rub.

Lastly, apply a new coating of wax.

For stubborn grease spots on dark solid-colour cottons—luncheon cloth or napkins, upholstery, cushion covers—try liquid shampoo.

Moisten the spot with warm water; rub liquid shampoo well in; roll up for a few minutes, then wash in hot water and detergent—but be sure of colour-fastness before you use that *hot* water. If in doubt use warm water.

How do you work?

"It's not how long you work, but how, that achieves results"—so if you've been finding yourself working too long for what you get done you may feel like examining the "how" of your work methods.

There is no "one best way" for everyone to do a job, but there may be "a better way" for each one of us if we would try to find out.

Keep a Record

For those who'd really like to come to grips with this "there aren't enough hours in the day" problem, a good starting point is to study on job.

It could be a job you do often, one which yo find hard to get done or one you don't lik doing.

The method of studying this job is to keep record of:

What you do step by step.

Distance you travel by steps or feet.

How long it takes to do the job (either complete or in sections).

Tools and supplies used.

A record of this kind can be made by th worker herself although it could be a handicap —better if a member of the family co-operated to check and record as the job progressed. (Thi latter approach could bear dividends in othe directions!)

Study the record with the aim of reducing time and labour by improving work methods, o storage or—whatever you find could be improved

One way of doing this is to find the answers to these questions:—

Can any part of the job be eliminated? (A simple example of this is not to peel all vegetables and to use stringless beans.)

Can parts of the job be combined? (Fo example, use a silver polishing cloth that cleans as it rubs, so doing away with need to apply polish separately.)

What unnecessary steps were taken?

Would planning ahead assist?

Can the order of the job be rearranged?

Is there a better way to do it?

Are the things I use stored where I use them first?

Do I use the equipment I have? Do I use it to the utmost advantage?

Do I day dream and dawdle? Nothing wrong with this if you've got time. If you haven't, try working against the clock to cut two, five or ten minutes off the time you usually take—but don't be so ambitious that you'll be heading for disappointment.

—From N.S.W. Department of Agriculture's "Press Copy."

TREATMENT FOR ELECTRIC SHOCK

In the case of severe electric shock, **follow these instructions even if the victim appears dead.**

The victim must be freed from the contact as promptly as possible. Use a dry stick, dry rope, dry coat (empty pockets) or other non-conductor.

If possible draw the victim away in one sweeping movement.

The use of your hands without protection is dangerous and may add another victim to the accident.

Expired Air Respiration consists of direct insufflation of the lungs by the rescuer blowing into the victim's nose (mouth to nose method) or his mouth (mouth to mouth method). In the event of failure to obtain insufflation of the lungs by one method the other should always be attempted.

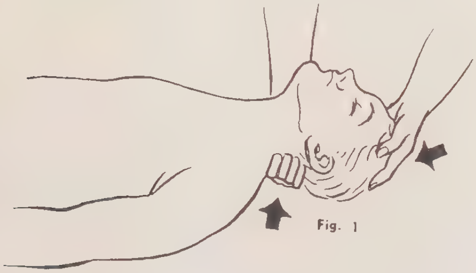


Fig. 1

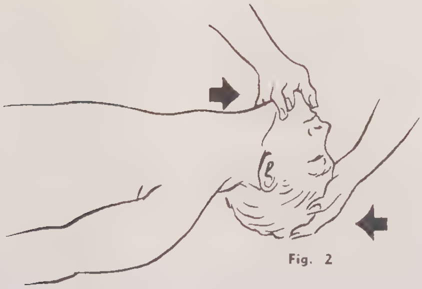


Fig. 2

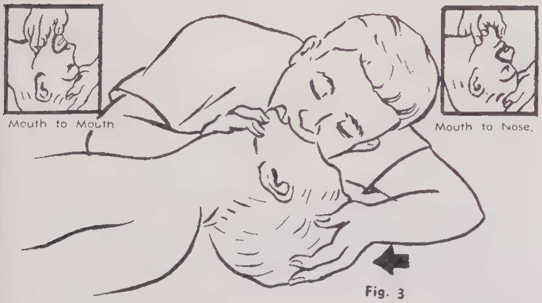


Fig. 3

Under certain circumstances this oral method would not be applicable and the manual method should be adopted.

These circumstances are:

(*a*) Extensive damage to the face including the nose and mouth, where there is a good deal of bleeding or where it would not be possible to obtain a proper seal of the victim's mouth or nose.

(*b*) In certain cases of poisoning with corrosive acids or alkaline substances where these poisons may be present in or around the mouth or nose.

(*c*) Asphyxia from certain poisonous gases (ethylene di-bromide or methyl bromide) or from readily volatile liquids.

In some cases of electrocution it may be unwise to apply oral methods, for example some cable jointing operations could result in discharge of a poisonous gas or substance. If oral methods are not applicable it is advisable for personnel to know an alternative method such as the modified Holger Neilsen method.

Place the victim on his back, face up.

Where a pad of clothing or similar material is **immediately available** place it under the victim's shoulders (clear of the neck) to raise them two or three inches above ground level.

If any foreign matter is visible in the patient's mouth, turn his head to one side, force his mouth open and quickly wipe his mouth and throat clean with the fingers or a piece of cloth.

The patient's neck must then be lifted (Figure 1). With one hand lift the neck upwards while a downward pressure is exerted with the other hand on his head.

Tilt the head as far back as possible by holding the crown of the head with one hand and pulling the chin upward with the other (Figure 2).

These operations must be carried out with the utmost speed to avoid delay in getting air into the victim's lungs.

Mouth to Nose Method

The rescuer should lie or kneel to one side of the victim's head so that he is looking downward into the nostrils and with his hands continuously maintain maximum extension and backward tilt of the victim's head while holding the victim's mouth closed. He then places his mouth right around both nostrils, well on the nose while his cheeks covers the victim's mouth. (Figure 3.)

Care should be taken to ensure a good seal with the rescuer's mouth and the victim's head tilt position is not altered.

The victim's lungs are inflated by blowing steadily, but firmly, down into the nose while maintaining the backward head tilt. The rescuer should not blow with an initial jerk, but steadily.

Continue to blow until the patient's chest expands noticeably or until the rescuer's lungs are emptied.

The rescuer then removes his mouth to a comfortable distance and allow the victim to breathe out automatically. When flow of air stops (determined by listening) the next breath is blown in. The first ten breaths should be deep and at a rapid rate to give a good quick supply of life-giving oxygen. The rate varies from up to 20 breaths per minute for children down to 10 breaths per minute for adults.

Mouth to Mouth Method

This method is similar to mouth to nose resuscitation except that the victim's lungs are inflated via the mouth instead of his nose.

Opening his mouth widely the rescuer places it tightly over the victim's mouth while pressing his cheek against the victim's nostrils to inflate the lungs, maintaining backward head tilt.

Continue artificial respiration without interruption until natural breathing is restored, if necessary **four hours or longer,** or until a physician declare the patient is dead.

As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. **Keep the patient warm.** Do not give any liquids whatever by mouth until the patient is fully conscious.

To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as a hot drink of coffee or tea, etc. No alcohol should be given. The patient should be kept warm.

Resuscitation should be carried on at the nearest possible point to where the patient received the shock. He should not be moved from this point until he is breathing normally of his own volition and then moved only in a lying position. Should it be neccessary, due to extreme weather condition, &c., to move the patient before he is breathing normally, resusciation should be carried on during the time that he is being moved.

A brief return of natural breathing is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched, and if natural breathing stops, artificial respiration should be resumed at once.

In carrying out resuscitation it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

The early administration of oxygen to patients suffering from effects of electric shock is of great advantage.

The ordinary and general tests for death should not be accepted and any doctor should make several very careful examinations and be sure specific evidence, such as the onset of rigor mortis, is present before the patient is pronounced dead, and resuscitation stopped.

If the manual method of resusitation is indicated—

As soon as possible feel with your fingers in the patient's mouth and throat and remove any foreign body (tobacco, false teeth, &c.). If the mouth is tight shut, pay no more attention to it until later. Do not stop to loosen the patient's clothing, but immediately begin actual resuscitation. **Every moment of delay is serious.** Proceed as follows:—

Position of Patient: Lay the patient in the prone position on a flat surface. Place the patient's hands one over the other, **under his chin.** The nose and mouth must be unobstructed.

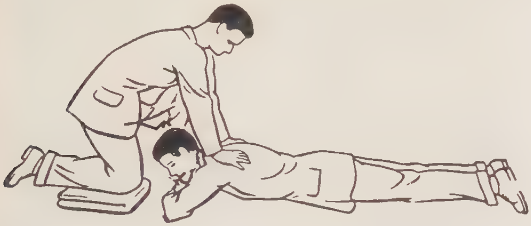


Fig. A

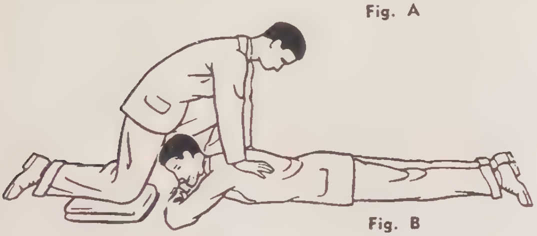


Fig. B

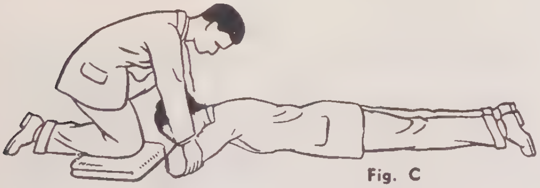


Fig. C

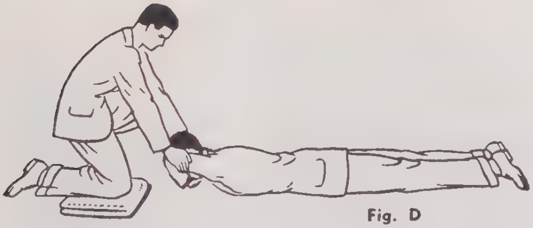


Fig. D

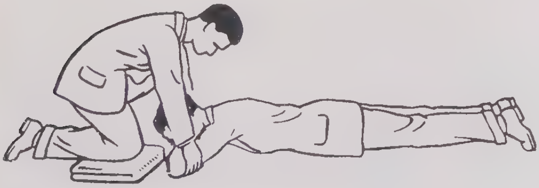


Fig. E

If another person is present he can best help by firmly grasping the victim's head and holding it up and bending the crown of the head towards the victim's back. This would ensure a much clearer airway.

Position of Operator: Place one knee with the inner side in line with the patient's cheek six to twelve inches from the top of the patient's head. Place the other foot with the heel in line with the patient's elbow.

Place the hands on the patient's back with the palms resting on the shoulder blades, the thumbs on the spine and the fingers pointing to the patient's feet. (Fig. A.)

Movement (1): Keeping the arms straight rock gently forward until the arms are vertical. Pressure should be light, without force—about 22-30 lb. for adults and 2-4 lb. for children. The movement takes 2½ seconds counting "One, two, three." This pressure causes expiration. (Fig. B.)

Movement (2): The operator now rocks back counting "four" and slides his hands past the patient's shoulders until they can grip his upper arms near the elbows. He raises and pulls on the arms for a period of 2½ seconds counting "Five, six, seven."

This movement causes inspiration. The arms should remain straight for the whole period. (Figs. C and D.)

Counting "Eight" the operator lowers the patient's arms to the ground and replaces his hands in the original position.

The whole operation should be rhythmic in character and should be continued until breathing re-commences. (Figs. E and A.)

When the patient begins to show signs of breathing the operator should continue with Movement 2 only, raising and lowering the arms alternately counting 1, 2, 3 (2½ seconds) for Inspiration, and 4, 5, 6 (2½ seconds) for Expiration. This will now give a rate of 12 times per minute. (Figs. D and E.)

—*State Electricity Commission.*

Top: Bridge Across Undulla Creek on the Property of Mr. Thorban Roberts, Meandarra. The bridge is used when there is a flood at shearing time to get sheep to the woolshed from the other side of the property. **Bottom: This kelpie-collie cross makes friends with Border Leicester stud sheep after hustling them into yards at the property of A. T. and M. Hamblin, Jimbour.**

Hay And Grain Feeder For Cattle

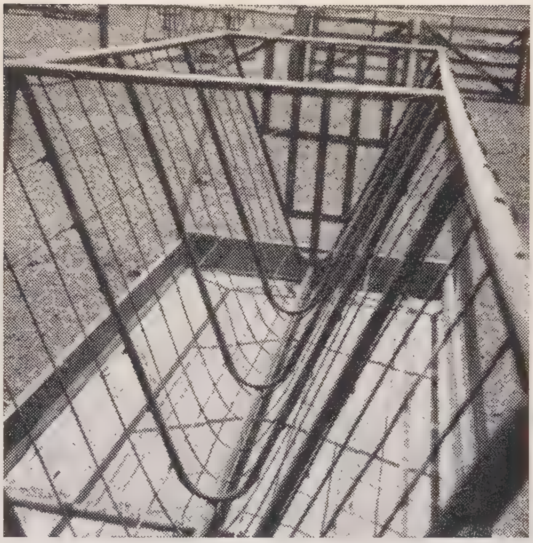


Plate 1: A Feeder Viewed from Above.

By G. W. MARLOW,
Adviser in Cattle Husbandry.

This article describes an economical and efficient hay and grain feeder for cattle that overcomes problems of wastage.

The cost of chaffing or milling hay before feeding is considerable. With the exception of hays of very low quality, chaffing or milling is unnecessary in many cases when the hay is fed to cattle. However, when hay is fed there are two main sources of wastage—and both are important. One concerns hay which is trodden on and fouled to the extent that stock won't eat it. The second is the loss of the most nutritious portion—the leaf—either by shattering and blowing away, becoming lodged in inaccessible places, through spoilage by weathering or in being trodden underfoot.

The late Mr. R. Graham, "The Cedars", Junabee, via Tannymorel, on the Darling Downs, looked at this problem objectively and after some exploratory visits to other feed lots designed the tubular steel combined long hay and grain feeder illustrated.

This feeder ensures the minimum of leaf wastage because as cattle pull the long hay from the steel wire rack the leaf falls into the grain trough where it is licked up.

The double-sided 12-ft. long feeder will accommodate 24 polled weaner steers or heifers comfortably. There is no pushing nor jostling for position. Each beast stands and pulls out its ration of hay.

Successful results have been obtained from the feed lot enterprise. Labour is saved to the extent that with these feeders one man can feed 80 head of cattle in 20 min. Thus, feeding out takes 40 min. of one man's time daily.

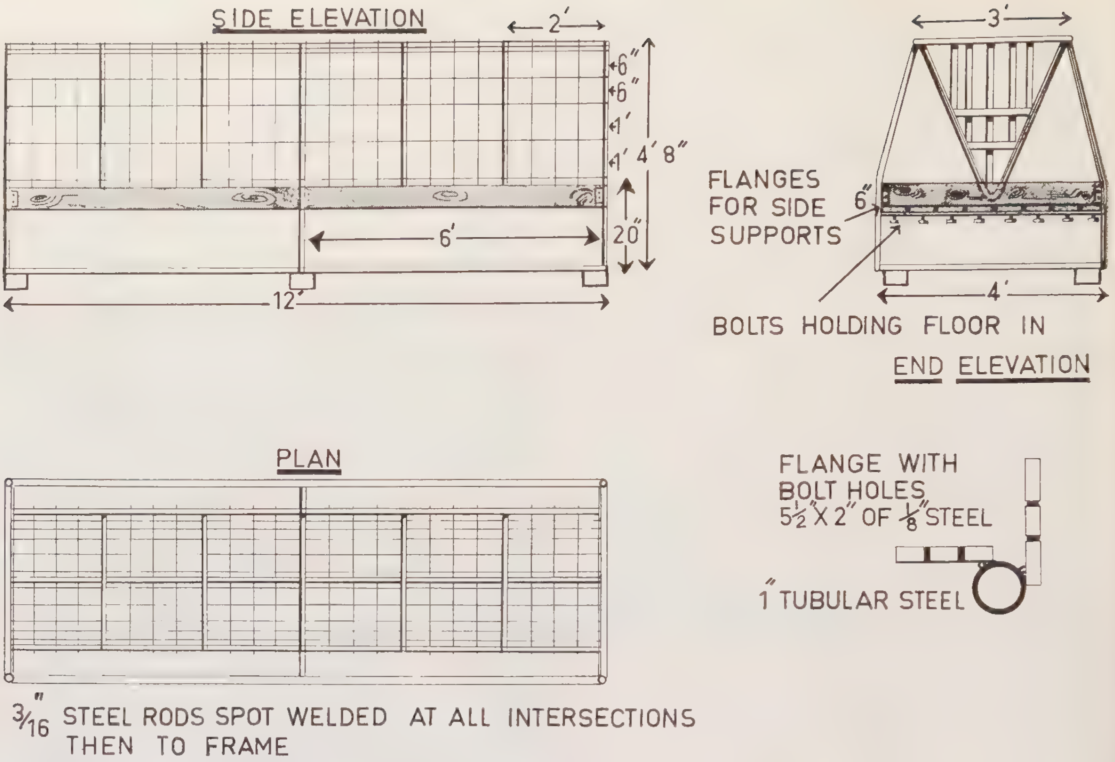

SIDE ELEVATION
2'
6"
6"
1'
1'
4' 8"
6'
20"
12'
3'
FLANGES FOR SIDE SUPPORTS
6"
4'
BOLTS HOLDING FLOOR IN
END ELEVATION
PLAN
FLANGE WITH BOLT HOLES 5½" X 2" OF ⅛" STEEL
1" TUBULAR STEEL
3/16" STEEL RODS SPOT WELDED AT ALL INTERSECTIONS THEN TO FRAME

Plate 2: Sketches of the Feeder Showing the Main Dimensions.

The feeders were constructed locally at a cost of £30 each. This cost could be reduced considerably by a producer with his own welder.

The feed tray is made of timber boards caulked with bitumen. The use of tongued and grooved seasoned timber would make caulking unnecessary.

The frame is constructed of 1 in. galvanised tubular steel. The wire rack is made from three-sixteenths of an inch steel wire. The lower cross wires are spaced at intervals of 1 ft. while the top three are 6 in. apart. The vertical wires are at 6 in. intervals. The decking of 6 in. x 1 in. hardwood boards is secured at each end to th cross members of the end frame pieces. Th bolts used are three-sixteenths of an inch. Ther are no bolts across the centre frame piece.

The side boards of 6 in. x 1 in. hardwood a bolted to $5\frac{1}{2}$ in. x 2 in. flanges of $\frac{1}{8}$ in. steel pla welded to the frame (see Plate 3).

The capacity of the rack would exceed 10 bal of hay if it were desired to pack it so tightly.

Experiments show that cattle are able to e very well and waste no leaf when loose hay portions of bales are packed tightly into the rac

Seasonal Greetings are extended to all Those Who Earn Their Living on the Land, with Sincere Good Wishes for a Happy and Prosperous New Year.

Director-General of Agriculture and Stock.

Nitrogen Lifts Wheat Profits From Old Cultivations

By J. W. LITTLER, Agronomist.

Nitrogenous fertilizer offers wheat growers a quick way of increasing their returns from land that has been under cultivation for many years. Net income can be expected to rise by £2 to £3 an acre from an application of urea at ½ to 1 cwt. an acre. Field trials by the Department of Agriculture and Stock in the Pampas district of the Darling Downs between 1956 and 1959 have given this evidence.

Experience in the older wheat-growing countries overseas has shown that continuous cropping without fertilizer in some form is followed by reduced yields. Many Darling Downs farmers have not yet been faced with this problem. In fact, some even believe that the fertility of the Darling Downs' soils is inexhaustible! But these farmers are growing wheat on the relatively new areas of the Downs.

Big areas of the eastern and southern Downs have been under cultivation for more than 50 years. Where this land has been used solely for cereal cropping, yields have declined. Land that once produced 12 bags of wheat an acre is now yielding only 6 or 7 bags. A decline in the protein content of the wheat has preceded the drop in yield. A protein content as low as 9 or 10 per cent. is now quite common.

This drop in yield is associated with a reduction in the level of both total and available nitrogen in the soil.

Colour a Guide

Apart from the evidence provided by soil analysis, the colour of the crop gives an indication of the variation in the levels of available nitrogen in the soil. Different shades of green colour are exhibited by the same variety of wheat in various cultivations.

To check the decline in fertility, and restore wheat crops to a healthy level of production, it is necessary to raise the amount of available nitrogen in the soil. One way to do this is to include a legume in the crop rotation. The legume may be used in a green manure crop, in a grazing and hay crop, or as a pasture component.

Another way is to supply the nitrogen artificially as a fertilizer.

In many overseas countries, including some States of the U.S.A., both practices are adopted. Farmers in England and Holland not only use fertilizer, including nitrogen, at heavy rates on cereal crops, but also fertilize the pasture within the rotation.

Queensland Studies

Investigations into the effect of nitrogen fertilizer on wheat quality were commenced by the Department of Agriculture and Stock in 1954. Observation plots were laid down in the Pampas area and fertilized with various rates of sulphate of ammonia and urea. Responses in both yield and protein content of the wheat were observed.

This work was followed up by more precise trials involving investigations on both the time and rate of application of urea to wheat.

A series of experiments was set out on a typical old cultivation in the Pampas district. The paddock was level and in first-class condition, free from weed problems and the harmful effects of soil erosion. The soil was representative of the district, a dark grey-brown clay of great depth. It had been under continuous cultivation for 70 years. A chemical analysis showed it to be low in total nitrogen, but high in both potash and available phosphate.

Field trials were commenced in 1956 and continued until 1959. These involved seven separate experiments, three main trials and four residual trials. Urea was applied at four different rates—0, ½ cwt., 1 cwt., and 2 cwt. an acre. It was applied at four stages of growth—sowing, tillering, shot blade and flowering.

At sowing, the urea was applied to the soil in solid form. In the three later treatments, the urea was applied as a foliage spray.

The crops were kept under observation during the growing period, and soil samples were taken from time to time to determine the level of soil nitrate. At harvest, yields were recorded and the grain was tested for quality and protein content.

The first response observed was a change in the colour of the foliage as a result of fertilizing at sowing time. This was clear in each of the three main trials within 5 to 9 weeks of sowing. Furthermore, colour differences were quite marked in the residual trials. Another change during the growing stage was an increase in the number of tillers in the fertilized plots.

Soil Nitrogen Measured

During the trial, soil sampling to assess the available nitrogen was carried out in co-operation with the chemical laboratory.

These tests showed that, in all three seasons, the soil was poorly supplied with available nitrogen at sowing time. On the average, the surface soil contained 6 parts per million of available nitrogen or 8 lb. an acre in the top 6 in. of soil. This compares poorly with the 50 lb. an acre regarded as being necessary for a 4 bus. crop at Rutherglen, Victoria.

Three feet down, the highest content of available nitrogen recorded was 4·8 p.p.m. In most instances, the soil contained between 1 and 2 p.p.m. Fluctuations in available nitrogen were restricted mainly to the top 12 in. of soil.

In both 1956 and 1958, when useful rain fell soon after the application of urea at sowing, the soil nitrate content built up early. For example in 1956, a figure of 37 p.p.m. for the surface 4 in. was recorded within 6 weeks from sowing compared with a mere 4 p.p.m. in an untreated plot.

In the dry year of 1957, no great increase in nitrate values was noted until the November sampling. The first useful rain fell on Octobe 9. This indicates that the nitrification of urea develops best in a moist soil.

Grain samples were examined to determine the degree of mottling in the grain, the protein content and the bread quality.

Highest protein content and least mottling were recorded when the urea was applied at the two stages of sowing and flowering.

Lifted Protein

In the main trials, urea applied at sowing increased the protein content from an averag of 9·7 per cent. in untreated plots to 12·7 pe cent. in plots treated with 2 cwt. of urea to th acre. Urea at ½ cwt. and 1 cwt. an acre gav average protein values of 10·5 and 11·7 pe cent. respectively.

Foliage sprays at flowering gave the followin protein values: ½ cwt. of urea to the acre, 11 pe cent. protein; 1 cwt., 12 per cent.; 2 cwt., 12· per cent.

The residual trials gave a similar picture o protein values increasing with the rate of application. Untreated plots had a protein value of 10· per cent. A sowing treatment of ½ cwt. of ure to the acre gave a protein content of 11 per cent 1 cwt. of urea gave 11·6 per cent.; and 2 cwt

12.8 per cent. Treatment at flowering gave the following residual effects: ½ cwt. an acre, 10·8 per cent.; 1 cwt., 11·7 per cent.; and 2 cwt., 12·7 per cent. Details of the effect of urea fertilizer on the protein content of wheat grain in these trials are given in Table 1.

TABLE 1

Grain Protein Percentages (at 13·5% H_2O)

Treatments	Trials								
	Main Trials			Average	Residual Trials				Average
	1956	1957	1958		1956 (1st Yr.)	1956 (2nd Yr.)	1957	1958	
Control (Untreated)	9·3	9·6	10·3	9·7	10·0	10·7	10·6	10·8	10·5
cwt. Urea Sowing	9·6	10·5	11·5	10·5	10·5	10·9	11·5	11·1	11·0
cwt. Urea Sowing	10·5	11·4	13·1	11·7	11·3	11·1	12·4	11·7	11·6
cwt. Urea Sowing	10·9	12·2	14·9	12·7	12·1	11·5	14·3	13·5	12·8
cwt. Urea Flowering	9·8	10·4	12·9	11·0	10·3	10·7	11·0	11·4	10·8
cwt. Urea Flowering	10·4	11·2	14·4	12·0	11·2	11·3	12·1	12·3	11·7
cwt. Urea Flowering	10·9	12·0	15·1	12·7	12·0	11·4	13·8	13·5	12·7

Mottling Reduced

Fertilizer also reduced the amount of grain mottling, both in the main trials and the residual trials. In the main trials, mottling dropped from 7 per cent. in untreated plots to 39 per cent. in plots treated with 2 cwt. of urea to the acre at sowing. Treatment at flowering had an even better effect in reducing mottling, with mottling down to 32 per cent. in plots treated at the 2 cwt. level.

In the residual trials, untreated plots had an average of 48 per cent. mottled grain, but plots treated at the 2 cwt. level at sowing had only 19 per cent. mottled grain. Plots treated with 2 cwt. of urea an acre at flowering had 24 per cent. of mottled grain. Details of the effect of urea in reducing grain mottling are given in Table 2.

TABLE 2

Percentage Estimation of Mottling in Grain Samples

Treatments	Trials													
	1956		1957		1958		1956 1st Year Residual		1956 2nd Year Residual		1957 Residual		1958 Residual	
	M.	B.M.	M.	B.M.	M.	B.M.	M.	B.M.	M.	B.M.	M.	B.M.	M.	B.M.
ontrol (Untr'ted)	85	31	60	37	56	11	44	22	53	10	57	12	37	14
cwt. Sowing ..	79	15	33	14	44	2	35	10	..	..	..	..	..	..
cwt. Sowing ..	70	7	27	10	37	1	24	6	38	5	34	2	12	1
cwt. Sowing ..	58	3	27	9	32	1	14	2	25	3	27	1	11	1
cwt. Flowering	74	6	36	17	40	1	33	20	..	..	..	..	..	..
cwt. Flowering	60	3	27	9	32	1	32	13	..	..	..	..	..	..
cwt. Flowering	50	4	18	6	27	1	11	3	48	4	30	1	8	..

M.= Mottled Grain B.M. = Badly Mottled Grain, that is, more than 50 per cent. mottled.

Effect On Yield

Urea gave the greatest increases in yield when it was applied at sowing. While unfertilized plots produced an average of 16·9 bus. an acre over the three seasons, treatment at sowing with 1 cwt. an acre gave an average yield of 23·9 bus. At 2 cwt. an acre the average yield was 26·6 bus., and at ½ cwt., 20·9 bus.

Fertilizing at flowering had less effect on yields.

Spraying with ½ cwt. of urea to the acre gave an average yield of 17.1 bus., 1 cwt. gave 17 bus., and 2 cwt. gave 16·1 bus.

Satisfactory residual effects were noted.

Details of yields from fertilizer applications the different stages of growth such as sowin tillering, shot blade and flowering, are set out Table 3.

TABLE 3

YIELD (BUSH/ACRE)

Treatments	Trials						
	1956	1957	1958	1956 1st Year Residual	1956 2nd Year Residual	1957 Residual	1958 Residua
Control (Untreated)	13·6	16·0	21·1	13·0	15·0	13·0	21·0
½ cwt. Urea/ac. Sowing	18·4	18·0	26·5	13·4	15·8	15·4	22·4
1 cwt. Urea/ac. Sowing	23·0	20·6	28·3	14·5	14·5	17·1	22·9
2 cwt. Urea/ac. Sowing	27·2	22·6	30·1	16·0	14·8	16·7	26·5
½ cwt. Urea/ac. Tillering	15·8	16·3	27·9	13·6	15·7	16·0	22·6
1 cwt. Urea/ac. Tillering	17·7	16·6	29·4	14·5	15·6	18·7	23·3
2 cwt. Urea/ac. Tillering	18·4	16·2	31·1	15·7	15·5	19·6	26·4
½ cwt. Urea/ac. Shot Blade	15·4	17·0	24·5	13·6	15·5	16·0	21·5
1 cwt. Urea/ac. Shot Blade	14·7	17·1	24·7	14·6	15·3	19·1	24·1
2 cwt. Urea/ac. Shot Blade	14·9	16·3	25·3	16·0	16·6	20·2	25·6
½ cwt. Urea/ac. Flowering	14·0	15·6	21·7	14·3	16·2	16·2	22·0
1 cwt. Urea/ac. Flowering	13·8	15·5	21·8	15·0	15·4	19·6	24·9
2 cwt. Urea/ac. Flowering	13·4	14·6	20·3	16·0	16·3	20·1	27·8

Financial Return

The trials showed that the best financial return is obtained by fertilizing early in the growth cycle with ½ cwt. to 1 cwt. of urea to the acre.

However, a big seasonal variation in yields and grain quality was also made clear. These variations are the result mainly of lack of moisture. If it is intended to use fertilizer on the crop at sowing time, it is well to ensure first that ample moisture is present in the soil.

—	Season		
	1956	1957	1958
Economic Treatment . .	1 cwt. sowing	1 cwt. sowing	½ cwt. tillering
Yield main trial bus./ac.	23·05	20·57	27·86
Yield residual trial . .	14·55	17·09	22·58
Yield Increases over untreated plots			
Main trial	9·4	4·53	6·75
Residual trial	1·59	4·05	1·59
Total yield increase . .	10·99	8·58	8·34
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Additional income/ac. . .	6 17 4	5 7 3	5 4 3
Additional costs/ac. . .	3 18 0	3 13 6	2 3 6
Additional net income . .	2 19 4	1 13 9	3 0 9

In calculating the extra financial return fro the use of fertilizer in these crops, residu increases in the following year were included. T determine the gross income, wheat was valued 12s. 6d. a bus. Extra costs consisted of ur at £60 a ton, bags at 2s. 6d. each, bag sewing 6d. a bag, and cartage to the siding at 1s. 6d. bag.

Bearing in mind that 1957, in particular, w a dry year, the trials clearly indicate that the of urea on wheat crops grown in old cultivati can be quite profitable. From the Pampas expe ments, it appears that net returns could increased by £2 to £3 an acre as a result applying urea at ½ cwt. to 1 cwt. an acre ea in the growing season. Table 4 sets out the co involved in using urea to fertilize the wheat gro in these trials, and the returns that were record

It is not suggested, however, that the use urea fertilizer on wheat crops is a substitute returning the land to a pasture rotation. But experiments do show that the use of a u fertilizer will increase yields and protein conte This method may be extremely useful to farm whose properties are less than 500 acres in ar

In the first instance it is recommended tha trial area be fertilized and the results record before whole farm fertilization is undertaken.

Cowpeas Boost Milk Production

By J. ONLEY, Adviser In Cattle Husbandry.

The value of cowpeas as a late summer and autumn grazing crop for dairy herds on the Darling Downs is being appreciated by more farmers each year.

If you speak to Mr. Joe Childes or his sons, George and Kevin, of Devon Park, near Oakey, you will soon realise how enthusiastic they are over the production they obtained from a 31-acre Commonwealth Dairy Industry Extension Grant (C.D.I.E.G.) demonstration planting of Poona cowpeas early this year.

On the average, production of Darling Downs dairy farms drops by 50 per cent. from January to June each year. This decrease in production and the subsequent slow recovery represent a loss of about 25 per cent. of our annual production.

In round figures that is about £10 per cow every year.

If this decline can be avoided it would mean a considerable increase in income to the dairyfarmer, with the added advantage of overcoming the drastic seasonal fluctuations in his monthly pay cheque.

The problem is essentially one of feed. Our commonly used summer grasses and grazing crops have a short growing season and mature quickly. Their content of an essential food factor—digestible protein—drops rapidly from January onwards. Hence, in a normal year our dairy herds reach a short-lived peak of production about January. A shortage of digestible protein appears to be the first limiting factor. Then by early winter, there is often a distinct lack of quantity of feed, in addition to the existing lack of quality.

By providing crops which maintain a suitable protein level for a period long enough to link up with early winter grazing crops, we can hold production at a high level much longer. Leguminous crops such as lucerne and cowpeas are the ones best able to do this.

The Plan

Even with a well-planned cropping programme and supplementary feeding with grain and lucerne hay, Mr. Childes could not stop his production falling by almost half between January and June. Then came the demonstration.

In 1960 he agreed to plant a 31-acre paddock of Poona cowpeas. This in no way interfered with his normal programme, because the peas were planted late in November in a paddock from which wheat had been harvested a few weeks before.

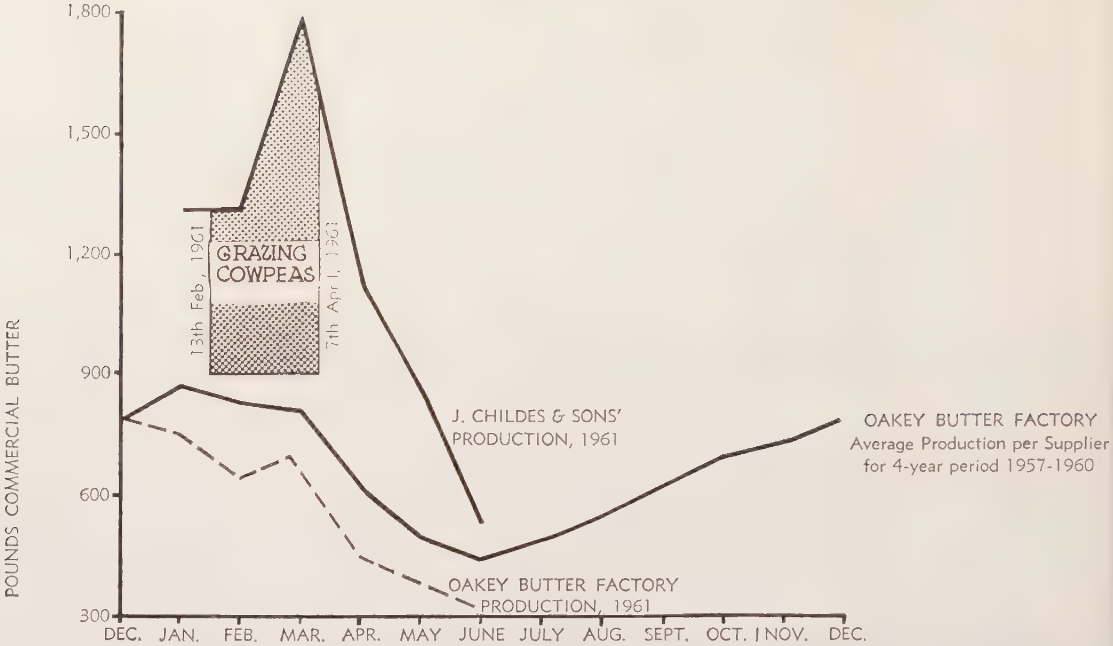


Plate 1: **Graphs of Mr. Childes's Herd's Production Resulting from Grazing on Cowpeas from February 13 to April 7, 1961.**

Plate 2: **Dairy Cows Grazing Cowpeas on the Darling Downs.**

Milk production on the Downs in early 1961 was well below average. In addition there was a drop of 40 per cent. in output from January o April.

On previous experience, Mr. Childes would have expected his production to follow the same pattern but at a somewhat higher level.

But, with the only alteration to his feeding being a daily average of 2 to 3 hours' grazing on cowpeas, his butter production in March reached an all-time record, and in April was less than 15 per cent. below the January and February production. This difference was not accounted for by any influx of new cows, but rather by increased production from the normal herd.

The results can be seen more clearly in Plate 1. The graph of average production per supplier on a monthly basis for the 4 years 1957-1960 shows he general pattern of decline in production from anuary to June each year and the subsequent radual rise from June to December.

The effect of the generally poor season in 1961 seen in the graph of this year's production, which is appreciably lower throughout than the average.

Compare this with Mr. Childes's production. or the period 1957-60, his production pattern or the first 6 months of the year was very similar the district average. This year, when the dis- ict production was below average and declining, s farm milk production for March was the ghest monthly figure he had so far achieved.

Unfortunately, due to the season, his early oat crop was not available in May to carry on the eding programme, and consequently production ter April dropped towards the level of other dis- ict farms. One of the major advantages, the maintenance of a high level of production in order make maximum use of winter grazing crops, as thus lost.

However, it can be seen that the cowpeas made marked difference to production during the late mmer and autumn period. The herd was main- ined in better body condition, also. Had reasonble rains been received their feeding period would ave been extended appreciably to link up ell with the first oat grazings.

The important question is, "What has this meant in terms of money to Mr. Childes?"

We know that in previous years Mr. Childes's production for the first 6 months of the year followed the same pattern as the district average but at a higher level. The percentage decline from January was similar in both cases.

If we take his January production as the starting point and apply the district pattern to the following months, we can estimate the amount of normal production. The difference between estimated and actual production can be attributed largely to the cowpea grazing. This is shown in Table 1:

TABLE 1

Month 1961	Actual Production (lb. C.B.)	Estimated Production (lb. C.B.)	Increase of Actual over Normal Estimated Production (lb. C.B.)
January	1,307	1,307	..
February	1,305	1,111	194
March	1,778	1,229	549
April	1,116	784	332
Total increase in production			1,075

1,075 lb. commercial butter at 3s. 6d. per pound is worth £188 2s. 6d.

From this must be deducted—

2 bags of cowpea seed at £8 15s.=£17 10s.

There are also ploughing and sowing costs. No extra labour or machinery were required but more efficient use was made of existing resources. The main added costs were for fuel and oil and a small charge for additional depreciation.

The £188 2s. 6d. worth of added production thus allows a good margin of profit from the paddock. Had seasonal conditions been more favourable, results may have been even better.

At the present time the readily available varieties of cowpeas are susceptible to stem rot. However, new varieties have been developed and seed supplies are being multiplied.

Until resistant types come on the market, growers should exercise the following precautions:—

1. Sow only in paddocks not previously planted to cowpeas.
2. Avoid low-lying, wet areas.

These precautions will not necessarily guara tee freedom from disease but will go a long w towards successful cowpea production.

In the past, cowpea grazing has not been us to anywhere near its potential. However, those farms where cowpeas have been used as valuable grazing crop, the dairymen have reap appreciable financial benefit.

Sorghum Responds To Fertilizer

Nitrogenous fertilizers have lifted grain sorghum yields by as much as 64 per cent. in trials on the Darling Downs. The Minister for Agriculture and Forestry (Hon. O. O. Madsen, M.L.A.) said this striking response has just been obtained in a trial near Allora. Besides boosting yields, the fertilizer has also raised the protein content of the grain as much as 23 per cent.

He said grain sorghum makes heavy demands on soil fertility. The introduction of hybrid sorghum next year promises to increase yields and make even heavier demands on soil fertility. Because of this, the hybrids may also bring soil fertility problems and the need to fertilize to maintain the gains made through breeding.

With this in mind, a trial was laid down on a 50-year-old cultivation near Allora to examine the response of grain sorghum to nitrogen fertilizer. In earlier trials in the Pampas district, winter cereals gave a marked response to nitrogen.

Mr. Madsen said there has always been considerable interest in the supply and use of nitrogenous fertilizers in agriculture. By means of improved techniques, industry has been able to reduce the cost of nitrogenous fertilizers and make their use more attractive to the farmer. The fertilizers at present in commercial use are sulphate of ammonia and urea.

The Agriculture Department is vitally interested in the use of these fertilizers in crop production. Under the supervision of the Chief Agronomist (Mr. V. J. Wagner), investigations into the place of applied nitrogen in winter crop production have been carried out on the Darling Downs for some years. Last season, the scope of these stud was enlarged to take in grain sorghum, Quee land's main summer cereal. An agronomi Mr. J. W. Littler, has been in charge of the tri in the field.

In his report on the sorghum trial, Mr. Litt said Alpha grain sorghum and a Queensland-b hybrid, A3197 X Alpha, were grown with a without fertilizer. Various rates of the fertili were tested.

Untreated plots of Alpha yielded 22·3 b an acre, and from the hybrid the yield was 2 bus. In the fertilized plots, the top yield of 3 bus. came from the hybrid in land treated with cwt. of sulphate of ammonia to the acre. Alp best performance was 31·3 bus. in land fertili with 1½ cwt. of urea to the acre.

The protein content of 10 per cent. in untrea plots was raised to 12·4 per cent. in Alpha 12·8 per cent. in the hybrid. Each of th high-protein plots was treated with 1½ cwt. urea to the acre. There was little difference the response of the crop to either fertilizer o nitrogen content basis.

The trial also demonstrated the capacity the hybrid to outyield Alpha, and the need adequate soil moisture when using nitrogen fertilizers.

Mr. Madsen said this trial left no doubt t sorghum yields and quality can be improved w fertilizers. It was planned to put down anot trial on the same land this season to see whet there is any carry-over of the fertilizer to next year.

Valuable Results From First Year Of Pig Testing

By F. BOSTOCK, Senior Husbandry Officer, Pig Branch.

A wealth of valuable information can be supplied to stud breeders as a result of testing carried out at the Department of Agriculture and Stock's Pig Testing Station at Rocklea.

The breeder's use of test results begins with the interpretation of the boar evaluation score. This score is based on the average performance of 16 pigs tested in accordance with the rules of the Station and has been designed to give prominence to the most important commercial characters, which are, food conversion, backfat thickness, body length, eye muscle development, shoulders and hams.

Because only a small number of pigs have passed through the Station, any conclusions drawn at this stage must not be taken as conclusive evidence. However an analysis of the results so far obtained reveals that improvement in all major characters can be secured if breeders select stock for breeding purposes from the progeny of boars and sows which have given good results under test for the particular character it is desired to improve.

This analysis concerns the individual pigs which passed through the Station in the first year of testing. All pigs were slaughtered at 200 lb. liveweight, cut and trimmed. Carcasses were assessed according to the standards set down by the Department.

The results are given in graphic form and represent the general indications on food conversion, body length, body length in relation to

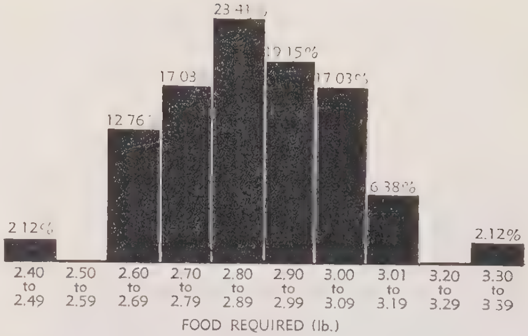
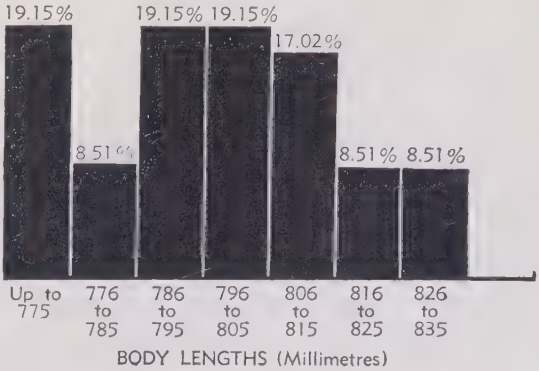


Plate 1: **Food Conversion Rate.** The amount of food required to produce 1 lb. liveweight gain is shown along the bottom and the bars represent the percentages of pigs that made 1 lb. gain on the amounts shown.

Plate 2: **Body Length.** The bars show the percentages of pigs in the various body length ranges.



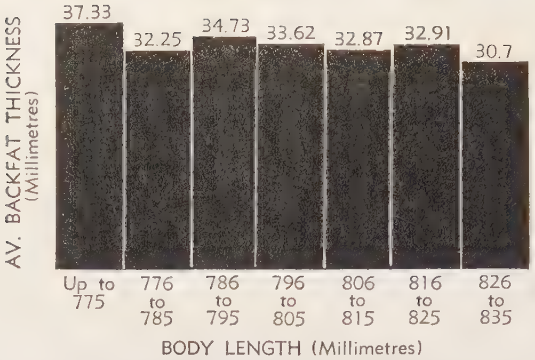


Plate 3: **Relationship between Body Length and Backfat Thickness.**

backfat thickness and backfat thickness in relation to eye muscle development.

Since all pigs are fed and managed under standard conditions the information refers to genetic variations. It is only by following the paths indicated in the results that a general improvement can be achieved.

Plate 1 indicates a fairly wide variation in the amount of food required to produce 1 lb. liveweight gain. However, food conversion of all pigs tested is considered to be good.

Body length is measured from the pelvic bone to the junction of the first rib with the sternum. Plate 2 shows the length of pigs tested, together with the percentage within each length range.

There is room for improvement, as over 40 per cent. of the pigs tested measured under 796 mm.

The average backfat measurement recorded is the average of the thicknesses of fat over the shoulder, loin and measurement taken 1½ in. from the centre line at the loin cut, and is

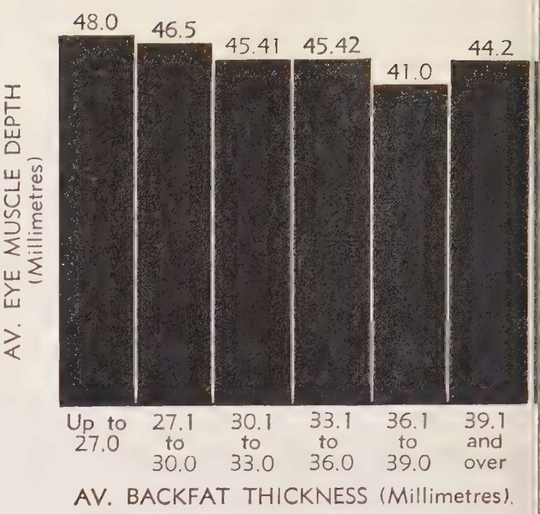


Plate 4: **Relationship between Backfat Thickness and Depth of Eye Muscle.**

rated above and below an optimum of 27 30 mm.

Plate 3 shows the relationship between bac fat thickness and body length, and clea indicates the tendency to a reduction of avera backfat thickness as the pig increases in lengt

The depth of the eye muscle, an indication the amount of flesh contained in the carcass, measured when the side is cut across at t junction of the last rib with the backbone. T size of this muscle influences the reception a bacon will receive from the consumer and therefore of great importance.

Plate 4 shows the average eye muscle measur ment of the pigs that passed through the Stati and its relationship to the backfat thickness.

It will be noted that eye muscle thickness greatest when average backfat thickness is lea

What is "Strategic" Dipping?

It is a strategy to prevent ticks completing their breeding cycle. Dipping within the parasitic cycle of 3 weeks prevents ticks from falling off to lay eggs. Tickicides with a residual effect allow this dipping interval to be extended to a period between 3 and 4 weeks.

Research has demonstrated that provided dipping is commenced in September and continued until December at short intervals then late summer infestations will be low, making long interv dipping possible until the following Septembe

This strategy should replace the old practi of dipping when tick infestation is obvious, whi allowed a build up in pasture infestation a eventually a serious "Tick wave".

—*O. BROOKS, Assistant to the Director,*
Division of Animal Industry.

A Pump For Liquid Manure

By J. B. AITKEN, Adviser, Pig Branch.

When pigs are housed under intensive conditions, the disposal of manure and washwater has been a problem. In recent years, however, the widespread use of drainage pits or sumps has avoided unsanitary fly breeding conditions.

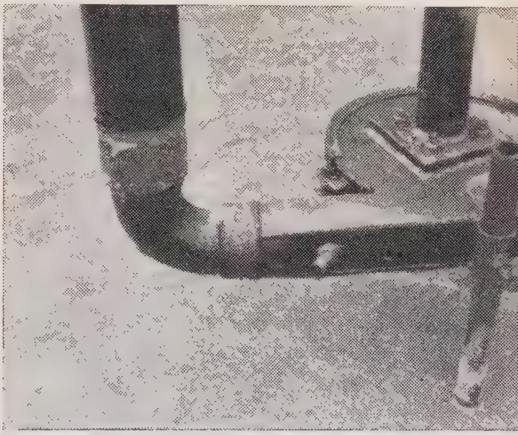
Pumping this sump material, which is a first class fertilizer, has been rather expensive and unsatisfactory, as it contains varying amounts of solids and fibre not suitable for normal pumping equipment.

Recently a simple centrifugal type pump capable of handling material from a piggery drainage pit was built at the Regional Experiment Station, Biloela. It operates from a submerged position near the bottom of the sump, support from the bottom being provided by an adjustable leg on the side of the pump casing. Power is transmitted by means of a shaft; on the bottom of this shaft vanes are attached, with pulleys at the top to take the V belt drive from the motor.

There are only three vanes or paddles, which are welded on top to a plate. Each paddle has a scallop 1 in. deep by 3 in. long cut out of the lower edge, near the shaft. The pump is enclosed by a 12-in. diameter casing which has an inspection plate on the side for easy checking of the paddles. The casing is 3 in. deep and constructed of one-eighth of an inch steel plate. The vanes are flat and are shaped from three-sixteenth of an inch plate. There is a quarter of an inch clearance between the ends of the vanes and the casing, and three-eighths of an inch clearance under the vanes.

The one and a quarter inch drive shaft is cut to suit the depth of the sump, and is covered by a length of 2-in. piping. A wood or wood and

Plate 1: **Pump, Showing Casing, Outlet and 3-in Delivery Pipe with Elbow, 2-in. Piping aroun Drive Shaft, and Adjustable Leg to support Pum from the Bottom of the Sump.**



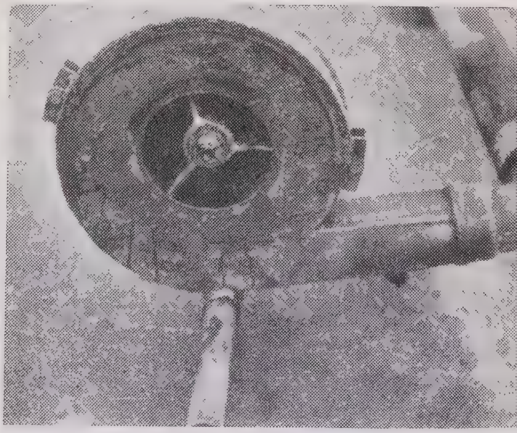


Plate 2: **Bottom of Pump, Showing Casing, 5-in. Opening, End of Shaft with Three Vanes attached to Plate and Shaft. Note also inspection plate on side of casing.**

Plate 3: **Pump Mounted in Sump.** Note the electric motor on frame, and clamps to hold shaft of pump rigid.

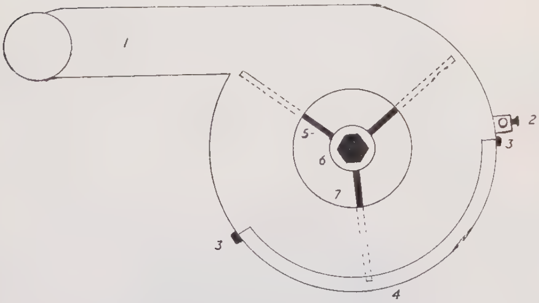


Plate 4: **Diagram of Pump.** The parts are: 1. discharge; 2. leg; 3. cover bolts; 4. cover; 5. paddle; 6. shaft; 7. 5-inch opening.

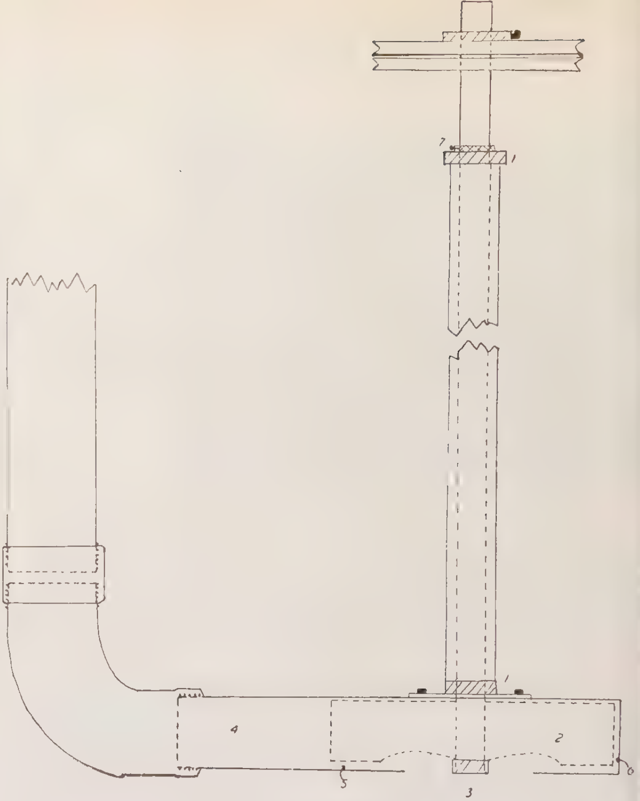


Plate 5: **Side View of Pump.** The parts are: 1. bearings; 2. paddle; 3. opening; 4. outlet; 5. $\frac{3}{16}$-in gap; 6. $\frac{1}{4}$-in. gap; 7. collar.

nylon bushed bearing is fitted at the bottom and a roller bearing at the top of the pipe. Stays from the side of the sump hold the pipe firm to prevent movement.

The pump at the Regional Station has been driven by a 5-h.p. electric motor with 6-in. pulleys, driving two V belts to 8-in. pulleys on the pumpshaft. A 3$\frac{1}{2}$-h.p. vertical shaft petrol engine driving from 3-in. pulleys to two 12-in. pulleys with A section belts has also been used successfully. The pump may also be adapted to tractor drive.

In tests carried out on the Station, this pump successfully handled sludge with a high proportion of solids and fibrous material and pumped at the rate of 300 gal. per min. Where there is a high proportion of solids, and material is being pumped considerable distances, some pipe blockages may occur but where frequency of pumping is reasonable no problem arises. The discharge from a 3- or 4-in. outlet was forceful and gave a wide spread of the solids.

This pump should be capable of handling any normal friction head to be expected on a piggery. At Biloela it is lifting material from the sump and pushing it 75 yd. through a 4-in. diameter pipe with two 90 deg. bends in the line.

The plans and photographs show the construction of the pump, in which heavy materials were used. The cost could be reduced considerably by using lighter material and secondhand parts. A forgeblower, for instance, will make a good pump from second-hand parts for about £20.

Ban Ban homestead on the bank of Barambah Creek, near Gayndah, is linked with an era of bullock drays and hewn slabs. A pioneer's homestead, it was built in 1850 by the Herbert Brothers, who first took up Ban Ban holding. Since 1913, it has been the home of Mr. and Mrs. J. C. Thompson.

In the long shadows of late afternoon, Albert Williams moves weaners from a grazing trial at "Brian Pastures" pasture research station, near Gayndah, quietly towards the stockyards. After a 16-hour fast the weaners are weighed. Agriculture Department research workers at "Brian Pastures" use records of weight gains to assess the value of different mixtures and methods of grazing management. Members of the 1961 R.N.A.-Shell Journalists' tour saw the weaners arrive at the yards.

Brucellosis-Tested Swine Herds (As at 17th November, 1961)

BERKSHIRE

Bernoth, B., Wyreema
Clarke, E. J., "Kaloon", Mt. Alford, via Boonah
Cochrane, S., "Stanroy", Felton
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Crawley, R. A., Rockthorpe, Linthorpe
Edwards, C. E., "Spring Valley" Stud, Kingaroy
Farm Home For Boys, Westbrook
Fletcher, A. C., "Myola" Stud, Jimbour
French, A., "Wilston Park", Pittsworth
H. M. State Farm, Numinbah
Handley, J. L., "Meadow Vale", Lockyer
Handley, G. R., "Locklyn" Stud, Lockyer
James, I. M. (Mrs.), "Kenmore" Stud, Cambooya
Kath, E. E., 225 West st., Toowoomba
Kimber, E. R., Block 11, Mundubbera
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View" Stud, Yandina
Ludwig & Sons, A. R., "Beau View" Stud, Beaudesert
Pfrunder, P. L., Pozieres
Potter, A. J., "Woodlands Plains", M.S. 247, Nobby
Q.A.H.S. & College, Lawes
Regional Experimental Station, Hermitage
Rosenberger, N., "Nevrose", Wyreema
Rosenblatt, G., Rosevilla, Biloela
Schellback, B. A., "Redvilla" Stud, Kingaroy
Smyth, E. F., "Grandmere" Stud, Manyung, via Murgon
Stark, H. L., "Florida" Stud, Kalbar
Traves, G., "Wynwood" Stud, Oakey
Weier, V. F., "La Cresent", M.S. 544, Clifton
Young, (Jnr.), W., Kybong, via Gympie

LARGE WHITE

Assenbruck, C., Mundubbera
Baker, R. L., "Baroma", Glenapp, via Rathdowney
Barron Bros., "Chiltern Hill", Cooyar
Behm, A. M., "Aleun", Wondai
Campbell, J. W., "Bunya", Bell
Coller, R. H., "Relloc", Tallegalla, via Rosewood
Cook, F. R. J., "Astonvilla", Middle Creek, Pomona
Coulsen, B. L. R., Wondai
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Evans, J., Cushnie
Fowler, S., "Kenstan", Pittsworth
Franke, H. J. and Son, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Gibbons, A. E. H., Mt. Glorious
Gibson, H., "Thistleton", Wootha Rd., Maleny
Glasser, D. H., "Yagaburne", Goondiwindi
H. M. State Farm, Numinbah
Hall, M., "Milena" Stud, D'Aguilar
Heading, Sir James, "Highfields", Murgon
Herbener, K., "Kevlan" Stud, Monto
Hickson, K. L., "Warree", Tableland Rd., Calliope
Hoey, T. W. & S. J., Mirridong Farm, Upper Forest Springs, M.S. 74, Clifton
Horton, C. J., "Manneum Brae" Stud, Manneum, Kingaroy
Hutton, G., "Grajea" Stud, Toowoomba
Jones, K. B., "Cefn" Stud, Clifton
Kahler, J. & S., "Karajoy", East Nanango
Kanowski, A., "Exton", Pechey
Kennard, R. B., "Collar" Stud, Warwick
Law, D. T., "Rossvill" Stud, Aspley
Lees, J. C., "Bridge View", Yandina
Lobegeiger, L. C., "Bremer Valley" Stud, Rosevale, via Rosewood
Mack, A. J., "Culzean", Mundubbera
Main, G., Mungungo, via Monto
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R., Ascot, via Greenmount
Palmer, V. P., & Son, "Remlap", Greenmount
Payne, F. & P., Beerburrum
Port Curtis Co-operative Dairy Association Ltd., Stud Piggery, Biloela
Postle, R., "Yarallaside" Stud, Pittsworth
Potter, N. R., "Actonvale", Wellcamp
Powell, R. S., "Kybong", Gympie
Q.A.H.S. & College, Lawes
Radel, V. V., Coalstoun Lakes
Radel, R. M., "Turua", Coalstoun Lakes
Regional Experiment Station, Biloela
Regional Experiment Station, Kairi
Robinson, O. R. & O. J., "Linvale", Argoon, Biloela
Rosenblatt, G., Rosevilla, Biloela
Sedgwick, F. G. & J. E., Mundubbera
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stephen, T., Withcott, Flagstone Ck.
Stewart, L., "Ban-Nookoo", Mulgowie, via Laidley
Stumer, K. F., French's Creek, Boonah
Thomas & Sons, "Rosevale", Laravale
Tinknell, H., Plunkett Road, via Tamborine
Trim, R. A., Gold Creek Rd., Brookfield
Wharton, C. A., "Central Burnett" Stud, Gayndah
Zahnow, W., Rosevale, via Rosewood

TAMWORTH

Armstrong, H. J., "Alhambra", Crownthorpe, Murgon
Booth, J. D., Swan Creek, Warwick
Fletcher, A. C., "Myola" Stud, Jimbour
Herbst, L., "Hillbanside", Bahr Scrub, Beenleigh
Kanowski, S. E., "Miecho", Pinelands
Potter, N. R., "Actonvale" Stud, Wellcamp
Salvation Army Training Farm For Boys, "Canaan" Stud, Riverview
Stephen, T., "Withcott" Stud, Flagstone Ck.

WESSEX SADDLEBACK

Coulson, B. L. R., Wondai
Douglas, W., "Greylight" Stud, Goombungee
Dunlop, J. B., "Kurrawyn", Acacia Rd., Kuraby
Grimes, C. W., "Laurel Lyn", M.S. 74, Clifton
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Kratzman, A. C., & Sons, "Silver Hills", Windera
Kruger & Sons, "Greyhurst" Stud, Goombungee
Lau, D. E., "Homevale", Goombungee
Law, D. T., "Rossvill" Stud, Aspley
Mack, A. J., "Culzean", Mundubbera
Scott, A., "Wanstead", Grantham
Smith, C. R., "Belton Park", Goombungee

LANDRACE

Alexander and Lundie, "Vanda", Biddeston
Ashwell, J., "Greenhill", Felton, via Cambooya
Behm, A. M., "Aleun", Wondai
Brosnan, D. J., "Bettafield", Mt. Murchison, via Biloela
Burnett, E. V., "Glenden", Tabooba, via Beaudesert
Carmichael, D. J. & J. P., "Junelea", Cushnie, via Wondai
Champney, K. J. & R. E., "Avon View", Wooroolin, Kingaroy Line
Coulson, B. L. P., Wondai
Coulson, Mrs. H. M., Wondai
Crawford, G. L., "Glenvillan", M.S. 90, Manneum
Crawford, R. J. and Sons, "Inverlaw", Kingaroy
Crothers, B. M., "Booligar", Clifton
Dower, R. J. & E. A., "Dowlea", Tingoora
Duncan, C. P., "Colley", Flagstone Creek
Fowler, K. P., "Northlea", Coalstoun Lakes
Franke, H. J. & Son, "Delvue", Cawdor
Garrawin Stud Farm Pty. Ltd., Samford
Grayson, D. G., "Wodalla", Killarney
Herbener, K., "Kevlan" Stud, Monto
Hickson, K. L., "Warree", Calliope
Itzstein, R. A., "Hyde Park", Gooroolba, Gayndah Line
Jarvis, O., Wondai
Jensen, A. P., & Grace, V. S., Theodore
Jones, K. B., "Cefn", Clifton
Kajewski, W. & Son, "Glenroy", Glencoe
Kath, E. E., 225 West St., Toowoomba
Kimber, C. C., Gooroolba
Kingsford, D., "San Antone", Middle Ridge, Toowoomba
Law, D. J., Rossville Stud, Aspley
Lusk, P. B. and I., Westbrook
Main, G., Mungungo, via Monto
"Marcliff" Stud, Wecker Rd., Mt. Gravatt
Neilsen, A. R. Ascot, via Greenmount
Nielsen, B. J., "Glen-View", Willowvale, Warwick
Neilsen, L. R., "Sunny Hill", Ascot, via Greenmount
Nielsen, K. & D., "Tellerton", M.S. 544, Clifton
Orange, L. P., "Eula", Toowoomba
Palmer, V. P. & Son, "Remlap", Greenmount
Phillips, D. G. & D. M. & Son, "Dorley", Murgon
Pointon, E., Goomburra, M.S. 869, Allora
Port Curtis Co-op. Dairy Assn. Ltd., Stud Piggery, Biloela
Powell, R. S., "Kybong", Gympie
Radel, R. M., "Turua", Coalstoun Lakes
Rosenblatt, G., "Rosevilla", Biloela
Semgreen, A. L. & D. J., "Tecoma", Kingaroy
Stehn, L. W., "Hodgson Vale", via Toowoomba
Stummer, K. F., French's Creek, Boonah
Trim, R. A., Gold Creek Rd., Brookfield
Weier, V. F., "La Crescent", M.S. 544, Clifton
Young, R. & C., "Dudley Park", Biggenden

LARGE BLACK

Pointon, E., Goomburra, M.S. 869, Allora

He Spent £1,000 On Irrigation

By L. A. WILLIS, Adviser in Cattle Husbandry.

When Mr. Jack Priebe, of Imbil, in the Gympie district, had an average production per cow of 202 lb. commercial butter in the 1953-54 season, he did not rest on his laurels. By a combination of wise breeding, balanced feeding and sound management, he gradually improved his herd production so that during the 1960-61 season his herd of 39 Jersey cows averaged 336 lb. of commercial butter per cow. This article discusses how he spent £1,000 on irrigation so as to re-organise his herd feeding, and the results he obtained.

In 1949, when Mr. Priebe purchased his 90-acre farm on Yabba Creek, near Imbil, there were 19 cows of mixed dairy breeds on the farm. On district figures these cows would have been producing an estimated 156 lb. of commercial butter per cow. By 1954, he had achieved the good figures of 36 cows averaging 202 lb. of ommercial butter from 90 acres. During these 5 years he improved the herd both in numbers nd quality. He supplemented the feed available rom pasture by growing 15 acres of maize, 10 cres of sudan grass and 15 acres of oats annually.

Irrigated Pastures

Planning for increased income and greater security, Mr. Priebe purchased an irrigation plant in 1954 and established 6 acres of an irrigated pasture sward of rye grass and clover.

An electric motor, pump and fittings cost £355, plus £150 for piping. Thus, for about £500, Mr. Priebe had the essential equipment for irrigating his pastures. He later bought an additional £500 worth of piping to extend his irrigation to 20 acres, thus bringing his equipment costs up to £1,000.

TABLE 1

Production Figures and Rainfall

Season	No. of Cows	Annual Production (lb. C.B.)*	Average Production per Cow (lb. C.B.)	Average Production per Ac. (lb. C.B.)	Gross Money Return		Rainfall (in.)
					per Cow	per Ac.	
					£	£	
952–53	36	7,974	222	89	44	18	44
953–54	36	7,259	202	81	40	16	42
954–55	36	7,179	199	80	40	16	76
955–56	36	7,538	209	84	42	17	62
956–57	36	7,440	207	83	41	17	34
957–58	36	9,840	273	109	55	22	39
958–59	36	9,840	273	109	55	22	52
959–60	39	12,480	320	139	64	28	42
960–61	39	13,107	336	146	67	29	30

* C.B. = Commercial butter.

All figures quoted in Table 1 are taken to the nearest whole number. The seasons quoted are taken rom June 1 to May 31 as that covers the season during which Mr. Priebe's cows are milking. The returns n butter and cash per acre in Table 1 are calculated on the basis of the whole 90 acres of the farm.

In 1954 and 1955, 6 acres of rye grass and clover were irrigated. During 1956, an additional 4 acres were planted to Priebe's perennial prairie, white clover and lucerne. This mixture was extended to 6 acres in 1957, 15 acres in 1958-59, and finally to 20 acres in 1960.

The production figures shown in Table 1 indicate a strong relationship between total production and area of irrigated pasture. An area of 6 acres of irrigated pasture and legume sward enabled Mr. Priebe to maintain an average production of 207 lb. of commercial butter per cow from 36 cows in the 1956-57 season, despite the fact that the rainfall was only about half that received during the 1955-56 season.

Following the establishment of an additional 9 acres of irrigated pasture sward in 1958, butter production per cow rose by 66 lb., giving a total increase of 2,400 lb. of commercial butter. At 4s. a lb., this represents an additional gross income of £480.

An additional 5 acres in 1960 enabled Mr. Priebe to add three cows to his herd and at the same time increase the production per cow to 320 lb. commercial butter despite the fact that rainfall was 10 in. less than in the 1958-59 season.

Thus, he increased his total butter production by a further 2,640 lb. of commercial butter which at 4s. a lb. represents an additional return of £528 more than he received in the 1958-59 season.

In the 1960-61 season, with 12 in. less rain than in 1959-60, he increased his total butter production by a further 627 lb. of commercial butter which at 4s. a lb. represents an additional return of £125 more than he received in the 1959-60 season.

Thus, by establishing 6 acres of irrigated pasture-legume sward, Mr. Priebe gained the security of being able to maintain a constant level of production irrespective of the rainfall received. By establishing an additional area of 14 acres he increased his gross income from dairy produce by the sum of £1,133 a year.

Plate 1: **On this Successful Farm, Surplus Irrigated Pasture Is Conserved as Hay.**

Another source of additional income has been an increase in the number of calves reared on skim-milk and home-grown feed. Until 1957, Mr. Priebe reared an average of 14 calves a yea Since 1958, he has reared 30 a year. Assumin that eight heifers per year are kept for her replacements, there are now an additional 16 he of heifers for sale.

If these calves are valued at £10 per head, th represents an additional income of £160 a ye due to the additional area of 14 acres of irrigat pastures.

By increasing his area of irrigated pastur from 6 to 20 acres, Mr. Priebe has increased h gross income by £1,293 a year. This is certain making full use of capital invested in irrigatio equipment.

Pasture Species

After trying various mixtures of rye gras clover and lucerne with mixed success, Mr. Prieb has now established an extremely good sward Priebe's perennial prairie, clover and lucerne. Th mixture has stood up well to 5 years of grazin without obvious signs of deterioration. Howeve Mr. Priebe plans to replant after 8 yea because couch grass tends to invade his pastur and may be a problem if the sward is left longe All legume seed is inoculated before planting.

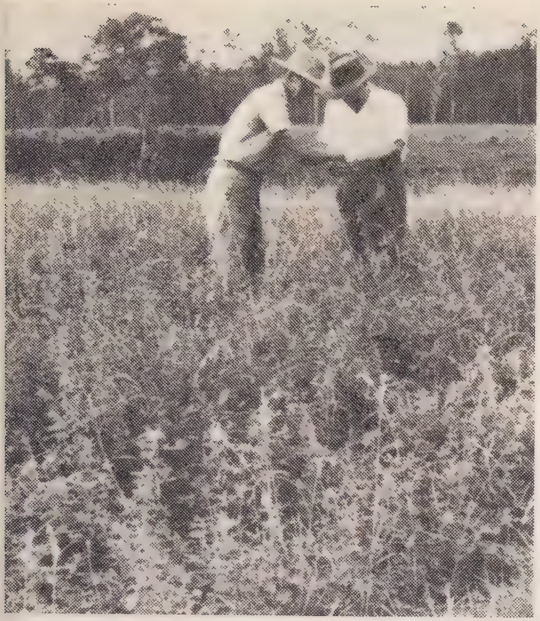


Plate 2: **Mr. Priebe Points Out the Seed Head of Priebe's Perennial Prairie.**

The sowing rates and costs per acre of this ixture, which has proved so successful on r. Priebe's farm, are:

	£	*s.*	*d.*
Hunter River lucerne— 4 lb. @ 6s. per lb. . . =	1	4	0
Priebe's perennial prairie— 8 lb. @ 3s. 3d. per lb. . . =	1	6	0
White clover—			
N.Z. mother strain— 1 lb. @ 6s. 9d. per lb. . . =		6	9
Ladino— 1 lb. @ 8s. 3d. per lb. . . =		8	3
	* £3	5	0

Seed cost per acre is thus £3 5s. at 1960 prices.

asture Management

Mr. Priebe states that Priebe's prairie grass s proved far superior to any other species he s tried on his farm. He has found that it will and up to a dry period if for some reason it is t possible to maintain the desired amount of rigating. He does endeavour to keep the ground moist at all times, particularly during the summer.

Frequent use is made of the mower to control the lucerne growth. By maintaining a good proportion of grass to clover and lucerne, Mr. Priebe is not troubled with bloat problems. His strip grazing management helps out here, too.

To obtain full benefit from irrigation it is essential to maintain a good level of soil fertility, and Mr. Priebe has not overlooked this most important factor. He applies fertilizer to his pastures every spring and autumn. The details of types and quantities of fertilizer used and their cost are set out in Table 2. It will be noted that a complete fertilizer has been used during the past 3 years.

TABLE 2

FERTILIZER APPLIED

Year	Type and Amount of Fertilizer Applied	Cost of Fertilizer Per Ton	Cost of Fertilizer Applied
1954–55	*Superphosphate* @ 2 cwt. per ac. per yr. on 6 acres = 12 cwt. per yr.	£15	£18 for 2 yr.
1956 . .	*Superphosphate* @ 2 cwt. per ac. per yr. on 10 ac. = 1 ton	£15	£15
1957 . .	As for 1954 and 1955 6 ac. = 12 cwt.	£15	£9
1958–59	*Superphosphate* @ 1 bag per ac. per yr. (160 lb. per bag) on 15 ac. = 30 bags in 2 yr. = 4,800 lb. in 2 yr.	£15	£32 for 2 yr.
	*A complete fertilizer @ 1 cwt. per ac. per yr. on 15 ac. = 30 cwt. in 2 yr.	£59	£89 for 2 yr.
1960 . .	*A complete fertilizer @ ½ cwt. per ac. on 20 ac. = 10 cwt.	£59	£30
	Molybdenised Superphosphate @ 160 lb. per ac. on 20 ac. = 3,200 lb.	£16	£23

Total cost of fertilizer applied over 7 years = £216. If the 1960 fertilizer rate is continued each year to maintain the present 20 acres the annual cost will be £53 = £2 13s. 0d. per acre.

* This fertilizer contains nitrogen 13 per cent., phosphorus 13 per cent. and potash 20 per cent. in a readily soluble form.

Irrigation Costs

From the rainfall pattern in the Gympie district, it is estimated that the maximum irrigation required for pasture would be 18 in. an acre a year, so that on Mr. Priebe's 20 acres of pasture, a total of 360 acre inches would be the maximum amount of irrigation needed in any year. This would involve 480 hours' pumping. Mr. Priebe uses a 15 h.p. electric motor with a 6 ft. lift. At an estimated pumping cost of 4s. an hour, this 480 hours cost £96. Water is pumped from Yabba Creek and there are no water storage costs involved.

The maximum cost of operating the pump to irrigate 20 acres, therefore, is £96, or approximately £5 an acre a year. In actual fact, during the 1959-60 season, Mr. Priebe's pumping costs were only £18. This is an example of how rainfall conditions can reduce the pumping costs far below the estimated maximum.

The costs incurred and gross returns obtained from this farm in 1957 with 6 acres of irrigated pastures are compared in Tables 3 and 4 with the costs and returns in 1961 when there were 20 acres of irrigated pasture.

From this comparison in Tables 3 and 4 it is shown that a cash increase return of £1,293—£194=£1,099 was obtained by increasing the area of irrigated pastures from six to 20 acres.

By 1960, therefore, Mr. Priebe had certainly achieved the target he set himself in 1954, which was security and increased income. He ha received a reward for increased work and skille management.

TABLE 3

COMPARISON OF ANNUAL COSTS

—	1957 (6 ac.)	1960 (20 ac.)
A—*Annual Cash Costs*—		
Estimated max. for irrigation and fertilizer	@ £6 10s. per ac. = £39 0s.	@ £7 13s. per ac. = £153 0s.
B—*Annual Allocation of Overhead or Fixed Costs*—		
Depreciation on Equipment (at 10%)	£50	£100
Interest on Investment (at 5%)	£25	£50
Annual Allocation of Seeding Costs (Cost of seeding divided by expected time before reseeding needed, which is 8 yr. in both cases)	£2 8s. 11d.	£8 3s. 2d.
Total Annual Costs of Irrigated Pastures ..	£116 8s. 11d.	£311 3s. 2d.

Increased cost by increasing area from 6 to 20 acres = £194 14s. 3d.

TABLE 4

COSTS AND RETURNS

—	1957	1961
Area Established	6 ac.	20 ac.
Seed per ac. ..	£3 5s. = £19 10s.	£3 5s. = £65
Fertilizer per ac.	£1 10s. = £9 0s.	£2 13s. = £53
Irrigation per ac.	£5 0s. = £30 0s.	£5 0s. = £100
Gross Returns..	7,440 lb. C.B. @ 4s.=£1,488 6 calves @ £10=£60	13,107 lb. C.B. @ 4s. = £2,621 22 calves @ £10 = £220
Total ..	£1,548	£2,841

Total increased gross returns = £1,293

Cow Feeding

All the feed eaten by Mr. Priebe's cows grown on his farm. The 20 acres of irrigate pasture provide the bulk of the feed.

The pastures are strip-grazed to avoid wastag of valuable feed. Excess pasture growth is mow and stored as baled hay. During 1959, a tot of 500 bales of hay was conserved from surpl growth from the irrigated pastures.

Approximately 9 acres of maize provide t grain part of the cow's diet. The maize a hay are hammer-milled and fed to the cows 2 to 4 lb. a day throughout their lactation.

All Mr. Priebe's cows have a 6 to 8 wee dry period. The top producing cows, in t 300 to 400 lb. butter range, receive the sam grazing and meal feeding as during their lact tion. The lower producers have the same gra ing but have their meal supplement cut out un about 1 week before calving, when they com back to a full ration.

The remaining 60 acres of Mr. Priebe's far comprise paspalum and kikuyu flats, with som forest grass ridges.

The farm is subdivided into 6 paddocks, an electric fences are used to strip-graze t irrigated pastures.

Wherever they are grazing, the stock ha good access to drinking water in Yabba Creek.

Pigs are run on the farm as a sideline. The ncome from pigs has not been taken into account n comparisons made in this article as the number f breeding sows has not been increased at any tage. Mr. and Mrs. Priebe do all the work on he farm, employing no labour.

By changing his feeding system from annual rops supplementing summer pasture species to system of 20 acres of irrigated pastures and acres of maize to supplement the summer astures, Mr. Priebe has not only ensured a ecure income but has increased his net income y over £1,000 per year. To achieve these emarkable results he has combined the factors of good stock which are fed well and managed wisely.

The results achieved show the value of irrigated pastures both as an insurance against droughts and as a means of increasing income. A small area will give insurance. A large area has given good returns. Of course, there is adequate water and both pastures and stock are well managed.

Mr. Priebe aims to push his herd production higher yet by breeding better cows. He places great importance on breeding cows that are capable of making the best of the good feed which he grows for them.

Don't Feed Cream To Pigs

Cream is too expensive to feed to pigs and alves, yet you could be doing this if your eparator is not in perfect mechanical condition.

A faulty separator can be costly. If it is not kimming efficiently, cream will be carried over nto the skim-milk and your factory returns will e down.

In the separator, the bowl and discs revolving t high speed separate the lighter butterfat from he heavier skim-milk. An understanding of this asic principle will indicate the importance of eeping the separator in good condition. Worn earings, a bowl out of balance and uneven drive an increase the quantity of cream left in the kim-milk. The separator should be lubricated orrectly and regular checks made on the conition of belts and pulleys.

The cream screw (or milk screw) plays an nportant part in good separation, for it controls ne butterfat content of the cream. The recomnended test for cream is between 38 and 42 er cent. in the summer and 34 and 38 in the inter. In most separators, one quarter turn of ne cream screw in an anti-clockwise direction ill reduce the test by about 2 per cent.

Farm separators are adjusted to separate milk at body temperature and at a certain rate of flow. For this reason, the milk in the vat should not be allowed to cool unduly, and the flow through the tap should be maintained at the required rate. This means adjusting the tap as the quantity of milk in the vat falls. If the bowl is too high or the milk flow is too fast, thin cream will be obtained.

The purpose of the sludge space in the bowl cover is to hold any foreign material like dust or cow-hairs that might find their way into the milk. As this space fills, the efficiency of the separator drops. It is useful to have a separator big enough to handle all the milk in three-quarters of an hour or less. If this is not possible, separation should be stopped after three-quarters of an hour and the bowl cleaned before the remainder of the milk is put through. This alone makes straining the milk going into the vat well worthwhile.

Trials to examine the factors influencing the efficiency of separation on Queensland farms are being conducted by the Department. Aim of the investigation is to reduce any high losses which are occurring.

—*W. D. MITCHELL, Senior Dairy Technologist.*

Tuberculosis-Free Cattle Herds (As at 17th November, 1961)

Aberdeen Angus

Bridle, W. N., Cabulcha Pty. Ltd., Caloola, Leyburn
Crothers, G. H. & H. J., "Moorenbah", Dirranbandi
Elliott, A. G., "Ooraine", Dirranbandi
Mayne, W. H. C., "Gibraltar", Texas

A.I.S.

Cox, T. L. & L. M. J., Seafield Farm, Wallumbilla
Crookey, J., Arolla A.I.S. Stud, Fairview, Allora
Davis, W. D., "Wamba", Chinchilla
Dennis, L. R., Diamondvale A.I.S. Stud, Mundubbera
Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
Evans, E. G., Lauraven A.I.S. Stud, Maleny
Green, D. B., Deloraine A.I.S. Stud, Fairdale, via Wondai
Heading, C. A., "Wilga Plains", Maleny
Henry, Mrs. K., & Sons, P.O. Box 4, Cambooya
Henschell, W., "Yarranvale", Yarranlea
H. M. State Farm, Numinbah
Kennard, R. B. & Co., Collar A.I.S. Stud, M. S. 848, Warwick
Littleton, H. V., "Wongalea", Bowenville
Marquardt, A. C. & C. R., "Cedar Valley", Wondai
McShane, A. H., Handford Road, Zillmere
Mears, G. S. & E., "Morden", M. S. 755, Toogoolawah
Moore, S. R., "Sunnyside", West Wooroolin, via Kingaroy
Neale, D. G., "Groveley", Greenmount
O'Sullivan, Con., "Navillus", Greenmount
O'Sullivan, P. W., "Navleigh", MS 371, Greenmount
Phillips, J. & Sons, "Sunnyview" A.I.S. Stud, Kingaroy
Pinwill, A. A., Gaylands A.I.S. Stud, Gayndah
Power, M. F., "Barfield", Kapaldo
Messrs. Mitchell and Mulcahy, Rosenthal
Queensland Agricultural High School & College, Lawes
Radel, R. R. & Sons, "Happy Valley", Coalstoun Lakes
Roche, C. K., Freestone, Warwick
Sanderson, W. H. "Sunlit Farm", Mulgildie
Schloss, C. J., "Shady Glen", Rocky Ck., Yarraman
Scott, M. E. & E., "Wattlebrae" A.I.S. Stud, Kingaroy
Scott, W. & A. G., "Walena" A.I.S. Stud, Blackbutt
Shelton, R. A., "Vuegon" A.I.S. Stud, Hivesville, Murgon
Estate Sokoll, A. H., "Sunny Crest", Wondai
Sperling, G., "Kooravale", Kooralgin, Cooyar
Sullivan Bros., "Valera", Pittsworth
Sullivan, D., "Bantry", Pittsworth
Sullivan, F. B., "Fermanagh", Pittsworth
Thompson, W. H., "Alfavale", Nanango
Webster, A. H., "Millievale", Sabine, via Oakey
Wieland, A. W., "Milhaven", A.I.S. Stud, Milford, via Boonah

Ayrshire

Dudgeon, Est. C. E. R., Marionville, Ayrshire Stud, Bald Knob, Landsborough
Dunn, T. F., "Alanbank", Gleneagle
Evans, E. R., Stimpsons Pty. Ltd., Loganlea
Goddard, B., Inverell, Mt. Tyson, via Oakey
Holmes, J. L. "Benbecula", Yarranlea
Mathie, E. & Son, "Ainslie", Maleny
Scott, J. N., "Auchen Eden", Camp Mountain
Zerner, G. F. H., "Pineville", Pie Creek, Box 5, Post Offic
Gympie

Friesian

Behrendorff, E. C., Inavale Friesian Stud, M.S. 786, Boonah
Macdonald, S. E. G., Conondale Rd., Maleny
Morrison, E. J., Cedar Creek, via Closeburn
Naumann, C. H., "Yarrabine", Yarraman
Pender, D. J., Lytton Road, Lindum
Stumer, A. O., Brigalow, Boonah
Superintendent, Marsden Home for Boys, Station Rd., Nth. Boo

Guernsey

Doss, W. H., Degilbo, via Biggenden
Fletcher, A. B., "Cossart Vale", Boonah
Holmes, C. D. (owner Holmes L. L.), "Springview", Yarraman
Johnson, G. L., "Old Cannindah", Monto
Miller, G., "Armagh Guernsey Stud", Armagh, M.S. 428, Grantham
Ruge, A. & Sons, "Woowoonga", via Biggenden
Scott, C., "Coralgrae", Din Din Rd., Nanango
Swendson, A. C., Coolabunia, Box 26, Kingaroy
Wissemann, R. J., "Robnea", Headington Hill, Clifton
Wilson, J. R., "Okeden", Proston

Jersey

Beckingham, C., Trout's Rd., Everton Park
Birt, W. C. M., Pine Hill Jersey Stud, Gundiah
Borchert, Mrs. I. L. M., "Willowbank" Jersey Stud, Kingaroy
Burrows, R. N., Box 23, Wondai
Bygrave, P. J. L., Craigan Jersey Stud, Aspley, Brisbane
Carpenter, J. W., Flagstone Ck., Helidon
Conochie, I. S., "Brooklands" Jersey Stud, Sherwood Rd., Sherwood
Crawford, R. J., Inverlaw, Kingaroy
Farm Home For Boys, Westbrook
Fowler, P. & Sons, "Northlea", Coalstoun Lakes
French, R. N., Chancelea Jersey Stud, Natural Bridge, via Nerang
Harley, G. W. & P., "Hopewell", East Nanango
H. M. State Farm, Palen Creek
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Johnson, H. G., Windsor Jersey Stud, Beaudesert
Lau, J. F., "Rosallen", Goombungee, Toowoomba
Matthews, E. A., "Yarradale", Yarraman
McCarthy, J. S., "Glen Erin", Greenmount, Toowoomba
Meier, L. E., "Ardath Stud", Boonah
Noone, A. M., & L. J., "Winbirra", Mt. Esk Pocket
Porter, F., Conondale
Q.A.H.S. & College, Lawes
Ralph, G. H., "Ryecome", Ravensbourne
Scott, Est. J. A., "Kiaora", Manumbar Rd., Nanango
Semgreen, A. L., "Tecoma", Coolabunia
Seymour, B. T., "Upwell" Jersey Stud, Mulgildie
Smith, J. A. & E. E., "Heatherlea" Jersey Stud, Chinchilla
Tatnell, W. T., Cedar Pocket, via Gympie
Toowoomba Mental Hospital, Willowburn
Verrall, F. W., "Coleburn", Walloon
Weldon Brothers, "Gleneden" Jersey Stud, Upper Yarraman

Poll Hereford

Anderson, J. H. & Sons, "Inverary", Yandilla
Angel, W. D., "Summerhill", Murgon
Hill, W. W., Mathalla
Hutton, D. R. & M. E., "Bellgrath", Cunningham, via Warwick
Kirby, A. E., "Lockington", Bogantungun
Maller, W., "Bore View", Pickanjinnie
Maller, W., "Bore View", Gowrie Junction
McCamley, E. W. G., "Eulogie Park", Dululu

Hereford

Messrs. Wilson & McDouall, Calliope Hereford Stud, Calliope

Poll Shorthorn

Leonard W. & Sons, Welltown, Goondiwindi
Q.A.H.S. & College, Lawes

Two Pasture Grasses Show Promise

By B. GROF, Agrostologist.

Rhodes grass has played an important part n the development of land cleared of softwood and brigalow scrubs in the 25 to 30 in. rainfall areas. It is a good colonizer and has proved very effective in the control of re-suckering on newly cleared land.

The main disadvantage of the commercially used strain is the almost continuous seeding durng the summer months. In seed, it is usually poorly accepted by stock.

Several forms of this grass, however, are characterised by a delayed appearance of the seedheads, and due to the widespread use of he grass in subcoastal districts, attention has been concentrated on these late maturing strains at the Biloela Regional Experiment Station.

One of these strains is Q.3307 Giant Rhodes grass. An introduction from Tanganyika, hrough the Mpurapura Pasture Research Station t Dar es Salaam, Q.3307 Giant Rhodes grass showed good promise over the years since its ntroduction in 1953. It is a robust growing orm of Rhodes grass. Flowering heads do not appear until April and the grass seeds only once n the season.

Giant Rhodes grass is strongly stoloniferous and it rapidly forms a dense sward. All parts of the plant—seedheads, stems and leaves—are arger than the similar parts of common Rhodes grass. In contrast to some of the high-yielding, ate flowering strains, Q.3307 Giant Rhodes train sets viable seed and stands establish readily from seed.

The stands of Giant Rhodes established from ocally harvested seed at the Biloela Regional Experiment Station maintained strain purity over the years. This suggests that the mode of reproduction in this Rhodes grass strain is non-sexual, a common phenomenon in some varieties of Rhodes grass. The commercial strain and some other late flowering forms reproduce by cross-pollination.

This is a point of importance because cross-fertilized strains would soon lose their identity in areas where common Rhodes grass is grown.

Mother seed increase of Giant Rhodes is in progress at the Biloela Station, and seed of this strain will be available for wider testing and further seed increase during the coming season.

Plate 1: Two Different Elephant Grass Selections at Biloela

Elephant Grass Selection 9-0-1

A leafy, vigorous variety of elephant grass was obtained at the Biloela Regional Experiment Station by selection from open-pollinated progenies of Q.2940 Elephant grass introduction, introduced by the Commonwealth Plant Introduction service from Africa as CPI. 7838.

Seed harvested from this strain gave rise to plants which showed great variability in stooling habit, plant height, stem thickness, density of foliage and date of maturity.

Of the wide range of types, several were selected for further observation.

It was noted that the late flowering, thick-stemmed types retained their succulence longer than the early flowering plants.

The aim of further selection was a late flowe ing type with thick succulent stems, strong crow dense foliage and vigorous stooling. The exce sively tall growth forms were discarded in prefe ence to a medium growth form which showe strong basal development. This selection exhibite pronounced vigour in comparison with the origin variety.

It was denoted as selection 9-0-1 and fie scale trials were established in the past season t test the merits of this selection. The selectio produced heavy tonnages of green material in th year of establishment.

Under raingrown conditions, 24·8 tons c green matter, equivalent to 4·3 tons of dr matter, were obtained per acre in 8 weeks.

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Plate 1: **The Blocks of this Cotton Variety Trial at Hermitage Regional Experiment Station are Separated by a Block of Sorghum.** The sorghum was planted to give a comparison of the return from both crops. The 60 bus. of sorghum harvested would net approximately £30 an acre as against £40 from 1,269 lb. seed cotton an acre obtained from the variety trial.

Bright Prospects For Southern Downs Cotton

By R. B. BYGOTT, Experimentalist.

Encouraging results have rewarded cotton growing trials by the Department of Agriculture and Stock on the southern Darling Downs.

In view of the relatively low returns from ummer grain crops in recent years, experiments vere initiated in the 1958-59 season to determine he value of cotton as an alternative crop for he southern Darling Downs. These trials were ocated at the Hermitage Regional Experiment Station (latitude 28·1 deg. S.) on the south-astern extremity of the Downs at an elevation of ,500 ft. above sea level.

While the Callide and Dawson Valleys of entral Queensland produce the bulk of our otton, the industry has now expanded consider-bly in southern Queensland, particularly on the orth-western Darling Downs and extending as far south as St. George in the south-west. At the present time cotton is not grown commercially on the southern Downs but our results from Hermitage should be of interest to cotton growers in southern districts considered marginal for the best cotton primarily on account of their relatively short growing season. Cotton takes about 6 weeks longer to reach maturity than the average grain crop such as sorghum.

Firstly, Hermitage conditions are considered from a climatic viewpoint in relation to other southern areas in Queensland with a similar environment.

Climate

As cotton is susceptible to frost damage the length of the growing season is determined by the normal occurrence of the first and last frosts.

A. L. C. Davidson in a recent article has stated that a "criterion in considering a district for cotton is that it should have an average frost-free period of 210 days or more. The frost-free period (in N.S.W.) is longer than the 190 days accepted in the U.S.A. because mid-summer temperatures are usually lower in N.S.W." Mid-summer temperatures are also lower in Queensland cotton growing areas so the same argument can be applied.

Under Queensland conditions, cotton is normally grown in areas which experience at least 8 months' (250 days) freedom from frosts, which should ensure maximum fruiting development. However, frosts are beneficial at crop maturity to assist boll opening and to check any undesirable growth, and it is of interest to record that very little cotton is grown commercially in the world today in completely frost-free areas.

Frost data from selected centres in southern Queensland have been listed in Table 1. For our purposes the average frost-free period has been determined as the number of consecutive days when the minimum air temperature has exceeded 36 deg. F. As Hermitage data correspond satisfactorily with Warwick, located only 6 miles to the west, the official Warwick figures have been quoted for uniformity. Biloela, as representative of the major cotton producing area of the Callide Valley in central Queensland, has been included as a basis for comparison.

TABLE 1

Frost Data, All Centres

Station	Years of Record From	Height above Sea Level (ft.)	First 36°F			Last 36°F.			Average Frost-free Period (36°)
			1	2	3	1	2	3	
Biloela	1930	530	May 23	13	Apr. 22	Sept. 12	15	Oct. 5	252
Dalby	1908	1,131	May 18	15	Apr. 17	Sept. 13	9	Oct. 1	246
Goondiwindi	1908	720	May 31	12	Apr. 17	Aug. 29	10	Oct. 16	274
Miles	1908	992	May 19	17	Apr. 17	Sept. 22	12	Oct. 21	238
Pittsworth	1909	1,698	May 27	21	Apr. 17	Sept. 1	16	Oct. 12	267
St. George	1913	650	May 28	16	May 1	Aug. 26	12	Sept. 16	274
Warwick	1908	1,485	May 12	18	Apr. 10	Sept. 20	10	Oct. 12	233

In Table 1.—(1) Denotes average date of first/last occurrence (10-year period 1930-39).
(2) Denotes average deviation from average date.
(3) Denotes first/last date of occurrence since 1908 or year mentioned in "Year of Record" colum
(Dates refer to the first/last occurrence of a screen minimum reading of 36 deg. F.—at thi air temperature it was assumed that a light frost would have occurred (frost temperatu at ground level 30·4 deg. F.).

Source.—Commonwealth Meteorological Bureau Bulletin No. 32. "Frost in the Australian Region".

In the Hermitage studies, more detailed observations were made of average air temperature, humidity and rainfall figures from Warwick, Miles and Biloela. Miles was selected as indicative of weather conditions on the north-western Downs and adjacent Maranoa division.

From all these meteorological data, it appears that Warwick is the least favourably situated climatically for cotton production, particularl with the shortest average frost-free growing perio of only 233 days. Normal limit for variation a Warwick is from 205-261 days with the shortes possible period on record being 180 days.

Conditions at Biloela are warmer, with highe summer rainfall and humidity, all these factor being conducive to better cotton growth.

rogramme

During the past three seasons an intensive trial rogramme with cotton has been conducted at ermitage over a wide range of soil types varying om the lighter sandy clays (fairly typical of the illside country on the eastern Downs) to the allow phased and deep black clay alluvials chernosems) indicative of the better class Downs ountry. Trials have embraced varietal testing for ield and fibre quality, seed treatment and time of lanting studies, fertilizer requirements, rotational ropping, seed increase of selected varieties and eneral crop culture. Our main trials were grown nder natural rainfall conditions and yields were btained by hand picking.

It is our intention to experiment with cotton at ermitage for at least 5 years to deter- ine the element of risk associated with cotton roduction on the southern Downs.

A two-row press wheel planter has been used o establish all trials. The press wheel action helps o consolidate soil around the seed. Combine lantings leave soil open and drying out occurs ore rapidly.

A seeding rate of 15 lb. to the acre was mployed and stands were thinned when necessary o 6 in. plant spacing.

Seasonal conditions experienced over the 3 ears of our cotton investigations at Hermitage ay be summarised briefly as follows:

1958-59. Following an early planting on ctober 3, good seasonal conditions were experenced, rainfall being 3 in. above average. Excelent yields up to 1,700 lb. of seed cotton to the cre were obtained.

1959-60. Crop failure due primarily to exces- ive rainfall (20·79 in.) over the September- ecember period compared with an average of 1·65 in. This was the highest rainfall received ver this period since detailed records were ommenced at Hermitage in 1946. These rains, ccompanied by cool overcast weather and ssociated low ground temperatures, provided xtremely poor conditions for seed germination, articularly on our heavier soil types. Early plant evelopment was retarded under these conditions nd the cotton then did not have sufficient time to et a crop before the first frosts early in May. nly token yields in the vicinity of 100 lb. to the cre were obtained.

1960-61. Despite such limiting factors as a relatively late planting on October 28, dry conditions over January-mid-February (with rainfall for the entire growing period being 2 in. below average), and restricted plant development, yields up to 1,440 lb. of seed cotton to the acre were recorded in our main varietal trial.

Thus we have enjoyed two successful seasons in our 3 years of cotton investigations at Hermitage. Important factors that have become apparent in our preliminary work are discussed:

Seed Treatment

The detrimental effect of low soil temperatures on cotton germination was well illustrated during the 1959 planting season when the majority of our plantings failed under cold, wet ground conditions. Seed rotting was also induced by poor aeration through soil crusting following high intensity storm rains. Germination took up to 20 days compared with 7 to 10 under normal conditions.

A series of seed treatment studies were conducted during 1960-61 season in an endeavour to stimulate the enzymes within the cotton seed and so promote earlier emergence under our conditions. Various chemical, fungicidal and heating treatments were involved but the only response was obtained by pre-soaking the seed in water at room temperature before planting. These experiments are to be continued and the possibility of using various plant hormones will be investigated.

Time of Planting

The importance of early planting in this district, with our short seasons, was emphasised in a "time of planting" trial during the 1958-59 season which yielded as follows:

Date Planted	*Total Yield (in lb./acre)*
3–10–58	883
10–10–58	1,098
10–11–58	332
1–12–58	20

From these results it is obvious that early planting is desirable, but as cotton is a warm weather plant it should not be planted before certain minimum soil temperatures have been attained. In this field we have been guided by

American research workers in using the following standards:

(1) Soil temperature at planting depth (2 in.) should be in the 65 to 68 deg. F. range or above, between 7 and 8 a.m. for three consecutive mornings before planting.

(2) The minimum soil temperature at a depth of 8 in. should not be lower than 60 deg. F. during any 24-hour period for 10 days preceding planting.

It is generally agreed that 60 deg. F. is the absolute minimum temperature for germination and early seedling growth.

Soil temperature studies have been carried o at Hermitage for the past three seasons and t progressive weekly averages over the main cotto planting period have been given in Table Additional air temperatures have also bee included. Extreme fluctuations in temperature a characteristic of this time of year, for example, 1959 the grass minimum temperature varie 32 deg. from 19 to 51 deg. during the first wee in October, while the daily maximum tempe atures in the third week differed by 25 deg. (fro 55 to 80 deg.).

TABLE 2

Weekly Average Weather Data—Cotton Planting Period—1958–60
Hermitage Regional Experiment Station

Week Ended	Soil Temperature					Screen Max.	Screen Min.	Grass Min.	Av. Hourly Temp.	Sunshine Hours	Total Rainfa
	7.45 a.m.			9.0 a.m.							
	2″	4″	8″	4″	8″						
21·9	58·1	58·7	..	59·0	59·9	71·5	44·8	37·0	56	8·3	51
28·9	54·4	54·8	..	58·8	59·7	70·4	44·9	38·0	55	8·0	47
5·10	56·0	57·4	59·2	60·2	61·0	74·7	44·0	37·3	59	9·3	39
12·10	56·9	58·7	60·7	62·9	63·7	75·8	50·2	43·8	62	8·5	58
19·10	58·4	59·2	60·7	62·7	63·2	72·4	46·6	41·6	58	9·1	108
26·10	61·5	62·1	62·0	65·7	65·8	77·3	49·5	43·3	61	10·5	133
2·11	61·5	66·5	66·9	69·0	69·0	82·9	53·8	48·0	66	8·5	116
9·11	64·4	64·9	62·0	70·2	70·0	82·3	53·2	47·9	67	10·5	60
16·11	63·3	63·6	..	70·1	70·4	79·0	58·2	54·4	67	7·6	154

Keeping the previous soil temperature standards in mind, it appears that normally we cannot plant before mid-October with any degree of assurance that the cotton will germinate before rotting. As the initial growth of cotton in this district is slow, very early planting may subject the plants to the ravages of cold, disease and insects, and seldom justifies the risks involved. As the exception to the rule, an early planting on October 3, 1958, on a lighter soil type (hillside area) produced excellent results in a very mild season.

Varieties

Varietal testing has formed the major part of our programme, to select suitable early maturing strains for this short season environment. While later varieties may have a greater potential in a good season, earliness in crop formation is considered an essential feature for the production of good quality fibre to ensure a reliable return from cotton in this district.

Yield data from our main standard variet trials in 1958-59 and 1960-61 are shown Table 3. The trial in 1958-59 was located a lighter sandy clay (hillside area) while th second trial was on a shallow phased chernose (black clay). An excellent trial on our dee

TABLE 3

Dryland Seed Cotton Yields (in lb./ac.), Hand-Pick

——	1960–61	1958–59
Dixie King	1,439	..
D and PL 15	1,422	1,700
Bobshaw	1,345	..
Empire	1,307	1,634
Stoneville 2B	1,281	..
Triumph	1,201	..
Arkot 2–1	1,188	..
Acala 5675	1,155	1,676
Mexico Acala	..	1,523
Miller 43–9	1,086	1,526
Mean	1,269	1,612

lack clays was destroyed by flood water in ebruary, 1959. Varietal trials on all soil types ailed during the disastrous 1959-60 season.

In this district two picks may be anticipated ver the late April to mid-June period.

Twenty-four varieties were included in obser-ation row plots in 1960-61 mainly for rating ccording to maturity. Empire, Bobshaw, Dixie ing, Acala 5675, Triumph and Lankart, which roduce approximately 65 per cent. of their otton for harvesting by mid-May, are the arliest varieties we have under test. It is hoped hat this percentage can be increased with new arieties recently introduced from overseas which vill be planted at Hermitage in the 1961-62 eason.

A remarkable feature of the cotton in 1960-61 vas the recording of yields up to 2,000 lb. to he acre (Lankart) on small structured plants average height 27 in.; internode length 1·2 in.) n our main observation trial, plant development eing restricted mainly by weather conditions.

Incidentally, one series of observation rows stablished on a hillside area in 1960-61 follow-ng a pre-planting irrigation of 3 in. produced ields up to 4,898 lb. to the acre (D & PL 15). n view of the small size of these plots (row ength 25 ft.) the results have no commercial pplication but they are of interest to illustrate hat cotton, under relatively ideal conditions, is apable of producing excellent yields in this istrict.

uality

The best quality cotton in this district is pro-luced from the bottom and middle crop forma-ions on the plant set during the main summer eriod. As our seasons taper off quickly the najority of the top crop bolls are generally indersized, open prematurely and contain a high roportion of tightly locked cotton. Results rom our fibre testing programme have been ncouraging and it is sufficient to record that he overall grading from the Cotton Marketing 3oard for our first and second pick cotton for 960-61 was good middling (light spot). As vas expected, the final clean-up pick in mid-June vas down graded as middling (spotted).

Varieties such as Dixie King, Empire, D & PL 5 and Acala 5675 conform to the spinner's recent demands for a longer stapled, finer and stronger cotton.

The high moisture-holding capacity of our heavier soils should prove an important factor in the production of good quality cotton fibre under natural rainfall conditions.

Fertilizer

The fertilization aspect of our work requires further study but no beneficial response was obtained to high applications of nitrogenous fertilizers in the poor 1959-60 season. There was also a tendency for the fertilizer to delay crop maturity which is an undesirable feature with our short growing seasons. Under good fallowing practices, our better class soils have a high nitrifying capacity which should be sufficient to meet crop requirements.

Soil nitrate studies in 1958-59 illustrated the high nitrogen status of our soils to a depth of 36 in. Readings were as high as 50 parts per million of nitrogen in the available nitrate form in the top 6 in. of soil early in the season.

Despite the high nitrate content of our more fertile soils, excessive vegetative growth has only been recorded in late planted (December) cotton under forcing weather conditions. Initially low temperatures and later crop formation should provide sufficient check on plant development from October plantings. In rotation studies, second year stands of cotton also exhibited normal growth.

Weeds

For most favourable weed control, as many as seven interrow cultivations have been required in a season, using the front, rear and mid mounted tine attachments on the tractor. Also cultivations are desirable to break the soil crust following high intensity storms in order to increase moisture penetration in subsequent falls. With the slow early growth in cotton in this district, efficient weed control is imperative particularly where such grasses as urochloa (liverseed) are troublesome. Chemical weed control experiments using pre- and post-emergence sprays are to be undertaken in the 1961-62 season.

Insects

It has been the policy in our varietal testing programme to apply sufficient insecticides to restrict, as far as possible, yield losses due to insects. Up to nine sprayings (using DDT and endrin) have been applied with our boomspray equipment in a season, at least double the number of sprayings which could normally be recommended in commercial practice.

Brown cutworms may reduce the stand by attacking the cotton at germination, as they did in November, 1960. The slow initial growth in cotton in this district is very susceptible to attack by such leaf-sucking insects as jassids and thrips which are prevalent during October and November. Cotton tip worm is usually active in October and December. Control of these later pests is considered desirable at the seedling stage to avoid severe terminal damage and to ensure unrestricted plant development.

As expected in a maize growing district, Heliothis are prevalent and occur from December onwards. Our major pest, rough boll worm, is evident in January and persists for the remainder of the season. The high incidence of these larvae may be attributed to the prevalence of one of their native host plants, *Hibiscus trionum,* commonly referred to as wild cotton, which is a serious pest of cultivated land in this locality. No pink bollworm have been recorded in our trials to date.

Because of the shorter growing season at Hermitage, the fruiting period is more restricted than in other cotton growing areas in Queensland. It is essential that no interruption to the growth cycle should occur at this stage, or the effect on yield of seed cotton could be disastrous. Accordingly, to control insect activity at critical stages in growth, timely spray applications should prove beneficial.

Diseases

Verticillium wilt, a soil-borne fungus, was recorded in the wet 1959-60 season on our heavier soil types, causing a considerable reduction in stand. The incidence of other plant pathogens such as boll rots and leaf blight has not been severe.

Summary

(1) Two successful seasons have been experienced in 3 years of cotton investigations at Hermitage over 1958-61. Average yield of hand-picked seed cotton from our main dryland varietal trials in 1958-59 and 1960-61 w 1,440 lb. to the acre. A crop failure w recorded in 1959-60 due primarily to excessi rainfall (20·79 in.) over the Septemb December period—only token yields in t vicinity of 100 lb. to the acre were obtaine

(2) Weather data submitted have indicat that the southern Downs is marginal for cott production with existing varieties, mainly account of its relatively short growing seas Our trials have emphasised the importance the introduction and selection of suitable ea maturing varieties capable of producing sat factory yields within our short season enviro ment. Such varieties would minimise the ri now associated with cotton production in th region. In comparison with central Queensla (Biloela) the potential fruiting period for cott in this district is more restricted and shou insects or any other factor interrupt the grow cycle, our yields will be seriously affected.

(3) While earliness in planting is of maj importance in this district, soil temperatur seldom reach a satisfactory level (above 60 de F. at planting depth) before mid-October ensure that the cotton seed will germinate befo rotting.

(4) The slow initial growth in cotton in t district is very susceptible to insect attack a weed competition and adequate control measur are considered desirable.

(5) For commercial production early varieti such as Dixie King and Empire may be recom mended. Both varieties yield satisfactorily a produce good quality fibre which conforms to th spinners' recent demand for a finer, stronger a longer stapled cotton.

(6) This article has been intended to discu the main aspects of cotton production that ha become apparent in our preliminary trials Hermitage. Further investigations along the lin indicated are considered necessary to confirm th encouraging results that have already bee obtained. With an assured market for goo quality cotton in Australia at a long term guara teed price of 14d. per lb. of seed cotton, prospec for future expansion of cotton on the Dow appear bright.

pasture and crop

Murru Potato In The Lockyer.—There are wo district potato crops each year in the ockyer district. The autumn crop, which is lanted in February and harvested May to July, nd the spring crop, which is planted in July to ugust and harvested November to December.

Varieties which sprout quickly and mature heir crops quickly are usually better suited to he climatic conditions which prevail in the istrict. Furthermore, because of the generally dopted practice of using local seed for the utumn crop, a short-season potato has a distinct dvantage over a later-maturing one. For this eason also, a variety must be suited to both the pring and the autumn crops.

At Gatton Regional Experimental Station Aurru was found to be slow in emergence and lso late-maturing. It originated in New South Vales as a seedling from the cross Gold Coin Saranac and has been known as S2680 for ome years.

It is a vigorous, upright type of plant having ght green foliage. Flowers are violet in colour ut flowering is rather sparse. The tubers are ormed at a distance from the plant and this nay lead to damage by cultivating implements. The tuber is firm and of a creamy colour with pink skin, and has good storage qualities.

In general it has been found that yields have een lighter than either Sebago or Sequoia, the tandard varieties for the Lockyer district. This nay have been due, however, to the fact that ne variety was so late that its yields were dversely affected by harvesting when the others ad reached maturity.

Because of its late maturing habit, this variety is not favoured in the Lockyer district where short-season varieties have proved to be successful and are needed for seed production for the autumn crop.

—G. FILET, Field Assistant.

Power Take-Off Capacity.—In recent months a number of instances of difficulties with P.T.O. drives have been brought to the notice of the technical staff of the Australian Tractor Testing Committee.

Mr. G. H. Vasey, Officer-in-Charge, Tractor Testing, in reporting to the Committee, explained that the difficulties that had arisen could be traced to a lack of knowledge on the part of the operator of the type of P.T.O. drive fitted to the tractor.

First, some P.T.O. drives have not been designed to transmit the full power of the engine at rated speed, and second, in others where the P.T.O. drive is through a separately lubricated box or unit, the lubrication employed is not suitable for continuous operation.

For example, such applications as pumping for spray irrigation put the P.T.O. under high and continuous loading of a sort quite different from that experienced when functioning a towed machine for which most P.T.O.'s were apparently designed.

Mr. Vasey pointed out that all Australian tractor tests already included a 1-hr. run at full load on the P.T.O. with the engine at the speed required to give the British Standard Speed of 540 R.P.M. on the P.T.O. shaft.

Before setting up drives from the P.T.O. to heavy continuous loads, it would be advisable in your own interests to obtain from the tractor distributor or manufacturer advice on the permitted rating of the P.T.O. under continuous loading.

—*C. G. Wragge, Agricultural Engineer.*

Your Fodder Crop Programme.—In our seasonal climate a planned fodder crop programme is necessary if all-the-year-round production is to be achieved.

In our livestock industries native pastures are the basic source of fodder. With their short period of seasonal growth they fall far short of an all-the-year-round supply. Improved pastures can extend the period of supply of nutritive fodder. But there is still that rather long gap in winter and early summer. This is where your planned fodder crop programme fits in.

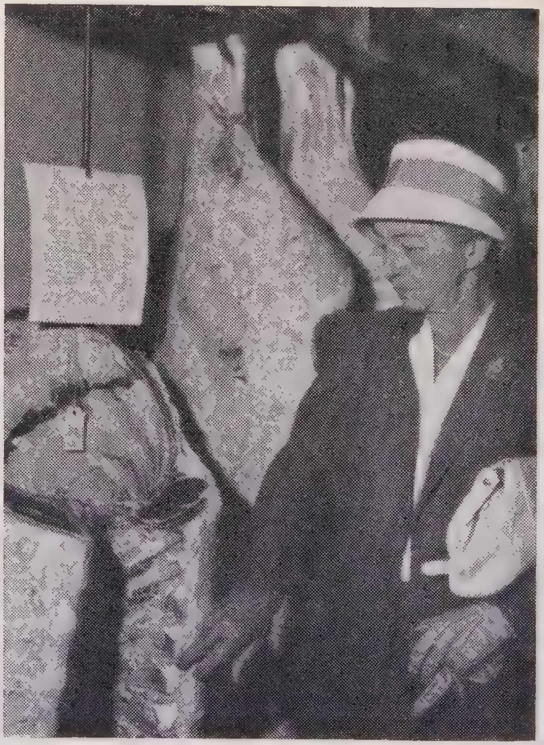
A winter growing fodder crop is the obvious need, and undoubtedly oats is the one most widely used—and the most productive. With th wide range of available varieties, plantings ca be staggered to provide feed from early winte to early summer. Your first planting shoul take place in February and planting can go o till June, depending of course on planting rains

While summer fodder crops can be grown t supplement native or improved pastures thei principal purpose in the fodder crop programm is to supply fodder for conservation either a hay, silage, or grain. This conserved fodder i then available for use in winter and earl summer. It is particularly necessary wher winter fodder crops are not a success.

The one summer growing fodder crop tha no livestock producer can afford to be withou is lucerne—and this crop can either be graze or made into hay. For silage purposes, maiz and sweet sorghum or sweet sudan are favourites For grain, either winter cereals or maize and grain sorghum can be grown.

—*V. J. WAGNER, Chief Agronomist.*

WOMAN EXHIBITOR'S SUCCESS



Mrs. I. M. Todd, "The Meadows," Dalby, the only woman exhibitor of fat cattle and carcasses at the 1961 Brisbane Exhibition, examines her first-prize-winning carcasses in the Thomas Borthwick and Sons (Australasia) Ltd. section for a pen of three steers suitable for export chiller trade. Mrs. Todd's cattle were fattened on green feed in her feedlot at "The Meadows." Advice on the feeding was given by the Department of Agriculture and Stock, which also carried out regular checks on weight gains.

Defeating The Funnel Ant

By G. W. SAUNDERS, Entomologist.

Success in dealing with funnel ant damage in Atherton Tableland pastures has come through ploughing and planting to suitable pasture species followed by sound management practices.

Soil-inhabiting funnel ants occur in many parts of Queensland, but have caused concern only in some of the high rainfall dairying districts. These ants are particularly troublesome on the Atherton Tableland, North Queensland. This area, originally dense rain forest, was cleared some 60 years ago. Within a few years paspalum became the dominant pasture species, and on many farms has been grazed more or less continuously ever since. Kikuyu grass was introduced about 30 years ago and quickly established itself.

Prevailing methods of pasture management over many years have resulted in declining soil fertility, and paspalum and kikuyu grass pastures have been invaded by the inferior narrow-leaf carpet grass. When funnel ants are present the problem is aggravated: the pastures deteriorate, bare patches of soil develop and deep-rooting weed species appear.

Funnel ants are not a problem where land is cultivated annually. Indeed, some early settlers sought funnel ant country for cropping as indicative of a deep, well-drained soil. These ants are not native to rain forest soils, but have migrated from adjacent open forest areas following clearing of the rain forest and subsequent pasture establishment.

Plate 1: **Well-Established Glycine with Green Panic in a Restored Pasture (Upper Barron, July, 1960).**

Plate 2: **An Old Pasture Invaded by Narrow-Leaf Carpet Grass and Funnel Ants (Upper Barron, July, 1960).**

Plate 3: **A Stand of Green Panic in a Funnel Ant Trial (Upper Barron, January, 1961).**

The worker funnel ants, about $\frac{1}{4}$ in. long, are honey-brown. The queens, five-eighths of an inch long, are much stouter than the workers, are darker in colour, and possess large abdomens. They may or may not possess wings. The males, about three-eighths of an inch long, are winged and are of slightly heavier build and darker in colour than the workers. A single colony consists predominantly of workers, with a few males and virgin queens and usually one egg-laying queen.

Ant activities are completely subterranean except when the males and females emerge for nuptial flights, or when workers build their mounds following wet weather. They do not forage above the ground bu ingest the soil. This action, combined with the loosening of soil when mound building, adversely affects the soil's physical structure and inhibits the growth of grasses.

Nuptial flights are brief, and swarms usually appear on a few days each year, more often in the spring months on a warm day following a period of wet weather. Mating takes place in the air. After fertilization the females fall to the ground, cast their wings and seek shelter beneath convenient objects. Dried manure pads and logs are sites of many new colonies. Here the queen excavates a small cell and lies dormant for 10 to 14 days while her eggs develop. The first eggs provide worker ants which guard and feed the queen, who continues egg-laying; and so the colony increases in size.

Control

Modern insecticides which have helped solve other ant problems have been tested during the past 10 years for the control of funnel ants in Queensland dairy pastures, but have proved of no practical value.

Outstanding economic restoration of productivity has been achieved by cultivation of damaged pasture land followed by replanting of grasses. This has been clearly demonstrated on the Atherton Tableland in trials, and commercially by farmers.

In the trials the land (approaching 20 per cent slope) was ploughed in the spring and contour banks established. Following three disc-harrowings in early summer, planting was carried out in January under favourable moisture conditions.

The legume *Glycine javanica* was planted with all grasses tested (green panic, Guinea grass, kikuyu grass, molasses grass, paspalum, and Rhodes grass). Green panic has proved the most successful for establishment in cultivated funnel ant country.

Experience has shown that early land preparation followed by early planting will ensure success if soil moisture is adequate. As a protection against seed-harvesting ants dry seed must be treated immediately before planting, the application being 3 oz. of 10 per cent. lindane dispersible powder per bushel.

Initial cultivation inhibits ant activity for about 18 months by which time the pasture should be well established. Subsequent management will determine how long the ants are kept in check.

The practice of cultivating old pasture land, growing cowpeas in summer and oats in winter, then sowing with grass the following summer is recommended for funnel ant country. Detailed advice on this phase of management may be obtained from local officers of the Agriculture Branch of the Department.

Scientific Names

Funnel ants	*Aphaenogaster pythia* For. *A. longiceps* F. Smith
Grasses:	
Green panic	*Panicum maximum* var. *trichoglume* (K. Schum.) Eyles
Guinea grass	*Panicum maximum* Jacq.
Kikuyu grass	*Pennisetum clandestinum* Hochst.
Molasses grass	*Melinis minutiflora* Beauv.
Narrow-leaf carpet grass	*Axonopus affinis* Chase
Paspalum	*Paspalum dilatatum* Poir.
Rhodes grass	*Chloris gayana* Kunth

Too Much Urea Spray Burns Pineapples

Heavy applications of urea sprays may cause severe burning of plants, as some pineapple growers have already found to their cost. This is due to excessive run-off and accumulation of a high concentration of the fertilizer in the heart and upper leaf bases, where most of the damage occurs.

No such injury occurs when the spray is limited to a fine mist and the leaves are just wetted. Once the leaves are thoroughly wet any surplus runs down and collects in the leaf bases and may even reach the heart, causing injury to the tender tissues. The type of burn is quite similar to that caused by other fertilizers. The injury is probably more general and more severe than that resulting from careless base leaf applications, largely because most of the spray run-off tends to collect in the centre of the plant. It is due primarily to the high concentration of urea present, and is quite distinct from the symptom of biuret toxicity, which results in yellowing and withering of the leaf tips.

Urea is taken in directly, and fairly quickly, through the leaves of a pineapple plant and there is nothing to be gained by putting on more spray than can be retained on the leaf surfaces. It is so easy to apply that growers can afford to spray fairly often, and two light applications are better than a single heavy one. Provided a fine mist spray is used, there is little risk of spray burn, even if it does come in contact with developing fruit. Sprays containing 10 per cent. urea applied every 2 months will be found sufficient under most circumstances. During the period of most active growth in the summer months it may sometimes be desirable to spray, say, every 6 weeks. If there is any reason to believe that plants are short of nitrogen, more frequent spraying should be adopted rather than increase the strength or amount of spray applied.

A large proportion of pineapple growers are now using these urea sprays because of the saving in labour and the fact that they provide a means of supplying nitrogen even in dry weather. Some care is needed, however, to avoid unnecessary plant injury.

—R. C. CANNON, Assistant Director of Horticulture.

QUEENSLAND ACCREDITED PULLORUM TESTED FLOCK SCHEME

The following stock suppliers registered under *"The Poultry Industry Acts,* 1946 *to* 1959," have been admitted to the Queensland Accredited Pullorum Tested Flock Scheme on the basis of blood testing results in 1961. Flocks are graded into two classifications—(1) *Pullorum Free:* Where no reactors are found at the annual test in the year in which an application is made, as well as in the preceding year, *or* where no reactors are found at each of two consecutive tests carried out at an interval of not less than six months. A pullorum free flock shall be classified as such until positive reactors are found at the annual test. (2) *Pullorum Clean:* Where the number of positive reactors detected at the annual test does not exceed ·5 per cent.

Name	Address	Hatchery	Supplying hatching eggs	*Breeds tested for supply of fertile eggs or day-old chickens
Class 1. (*Pullorum Free*)—				
Badcock, W. S.	Finucane Road, Capalaba	+		A.O.W.L.N.H.M.
Basnett, A. M. and A. B.	31 Duncan Street, Wynnum West		+	A.O.W.L.
Bell, Miss D. J.	Boundary Road, Darra	+		A.O.W.L.
Bone, C. and N. V.	340 Rochedale Road, Rochedale	+		A.O.W.L.M.
Careclas, C.	North Street, Wilsonton, Toowoomba		+	A.O.W.L.N.H.
Carpenter, J. W.	Post Service 1880, Helidon		+	W.L.N.H.
Chapman, Mrs. E. M.	Ipswich Road, Oxley, Brisbane	+		A.O.W.L.L.S.R.I.R.
Conroy, V. P.	Biddeston, via Oakey		+	A.O.W.L.
Corbett, R. B.	P.O. Box 4, Woombye	+	+	A.O.W.L.
Dearling, V. R.	61 Holberton Street, Toowoomba	+	+	A.O.W.L.
Gamble, N. C.	Biddeston, via Oakey		+	A.O.W.L.N.H.
Harvey, J. T.	P.O. Box 288, Mackay	+		A.O.W.L.
Jorgensen, H.	Gympie Road, Aspley	+		A.O.W.L.
Kirkby, K. S.	772 Manly Road, Tingalpa	+		W.L.N.H.
Knopke, R. J.	Anderson Street, Cairns	+		A.O.W.L.N.H.
Lister, E. B.	Corio Hatchery, 25 Haig Street, Toowoomba	+		A.O.W.L.N.H.
Mengel, A. E.	181 Campbell Street, Toowoomba	+		N.H.
Mengel, C. J.	50 New Lindum Road, Wynnum West	+		A.O.
Seppanen, A. G.	Freeman Road, Richlands	+		A.O.W.L.
Shale, W. R. C.	503 Tingalpa Road, Hemmant	+	+	A.O.W.L.N.H.
Sherrie, G.	M.S. 1497, South Street, Toowoomba	+		A.O.
Skett, E. E.	Hoepper Street, Toowoomba		+	A.O.W.L.
Spicer, F. E.	66 Duncan Street, Wynnum West	+		A.O.W.L.
Stanfield, C. F.	2311 Logan Road, Eight Mile Plains	+		A.O.W.L.
Thompson, J. F.	Pacific Highway, Eight Mile Plains	+		A.O.W.L.
Weaver, G. A. C.	P.O. Box 240, Atherton	+		A.O.W.L.
Winwood, G.	Old Cleveland Road, Belmont	+		A.O.W.L.
Class 2. (*Pullorum Clean*)—				
Adams, C. R.	Gerrard Street, Middle Ridge, Toowoomba		+	N.H.
Baker, G. E.	Ferry Road, Moggill, Brisbane		+	A.O.W.L.R.I.R.
Bauer, J. S.	" Triangle " Stud Hatchery, Oakwood, Bundaberg	+		A.O.W.L.R.I.R.
Bowtell, C. W.	4 Payne Street, Toowoomba	+		A.O.W.L.
Bowtell, J.	North Street, Wilsonton, Toowoomba	+	+	A.O.W.L.
Brand, G. A.	Parkhurst, via Rockhampton	+		A.O.W.L.L.S.N.H.M
Downs Hatchery	4 Thorn Street, Toowoomba	+		A.O.W.L.N.H.
Elks, D. J.	Woodlands Poultry Farm, Beerwah, North Coast Line	+		A.O.W.L.
Gisler Brothers	492 Wynnum Road, Wynnum	+		A.O.W.L.M.
Gray, A. H.	768 New Cleveland Road, Gumdale	+		A.O.W.L.
Hargreaves, K. R.	Bedford Road, Andergrove, North Mackay	+		A.O.W.L.
Harper, A. W.	Arenga Street, Tingalpa, Brisbane	+		W.L.A.O.
Hills, F. E. and Sons	" Littlemore," Sims Road, Bundaberg	+		A.O.W.L.R.I.R.N.H.
Hoopert, A. E.	24 Greenwattle Street, Toowoomba	+		A.O.W.L.R.I.R.
Jamieson, J. A.	84 Randall Road, Wynnum West	+		A.O.W.L.
Langan, J. P.	120 Wynnum Road, Wynnum West	+		A.O.W.L.
Lax, G. E.	Pinklands, Cleveland	+		A.O.W.L.
Lindsay and Dobson	Morayfield, North Coast Line	+		A.O.W.L.
Lingard, S.	Sunridge Poultry Farm, Buderim	+		A.O.W.L.N.H.
Loveday, G. C.	" Attinga," Bruce Highway, Beerburrum	+		A.O.W.L.
Luke, N. E.	P.O. Box 141, Warwick	+	+	A.O.N.H.
Mann and Son	M.S. 195, Pittsworth		+	N.H.
Markwell and Miller	" Bingelima " Hatchery, Markwell Road, Caboolture	+		A.O.W.L.
Millman, H. H.	" Kingaroy Hatchery," P.O. Box 215, Kingaroy	+		A.O.W.L.R.I.R.N.H.
Moffat, A. K.	337 Mount Gravatt–Capalaba Road, Upper Mount Gravatt	+		A.O.W.L.
Moore, W.	1039 Broadwater Road, Mount Gravatt	+		A.O.W.L.
Moss, C. L.	Moss Road, Manly	+		A.O.W.L.N.H.
Obst, H. and Sons	" College Holme," Shepperd, via Toowoomba	+		A.O.W.L.
O'Sullivan, J. V.	Glen Road, Warwick		+	A.O.W.L.
Queensland Agricultural High School and College	Lawes		+	Various
Rub, A. J.	Nelson Street, Middleridge, Toowoomba		+	N.H.
Rumball, I and J.	Messines Ridge Road, Holland Park, Brisbane	+		A.O.W.L.
Schumann, C. and M.	Corner of Toohey and Monash Roads, Tarragindi	+		A.O.W.L.
Slaughter, R. E. and M. H.	Beams Road, Aspley	+	+	A.O.W.L.
Stehn, H. W.	283 West Street, Toowoomba	+		A.O.W.L.N.H.
Stehn, L. W.	Hodgson Vale, via Toowoomba		+	A.O.W.L.
Tesch, E. R.	Waterford		+	W.L.R.I.R.
Thorpe, H. G.	24 Augstein Street, Coopers Plains	+		W.L.R.I.R.A.O.
Vickers, R.	2130 Logan Road, Upper Mount Gravatt	+		A.O.W.L.
Warman, W. A.	D'Aguilar, Kilcoy Line		+	A.O.W.L.

* Breeds (abbreviations) :—

A.O. = Australorps ;
N.H. = New Hampshire ;
L.S. = Light Sussex ;
R.I.R. = Rhode Island Red ;
M. = " Meat type " breeds ;
W.L. = White Leghorn.

Conserving Soil In Granite Belt Orchards

By A. R. CARR, Experimentalist.

In the Granite Belt, the soils are generally sands or sandy loams and lack good binding qualities. Erosion is therefore severe and takes place even on gentle slopes. When faced with the question, "What can be done to stop erosion?" the answer is simply, "Plant fruit trees on contour banks and cultivate only across the slope."

With the advent of better farm machinery, orchard tillage at Stanthorpe is often too frequent and, as cultivated ground is necessarily unstable, the soil is very susceptible to erosion. The effects of erosion are hardly noticed when land is first cleared but become increasingly apparent within a few years after establishing trees on sloping land.

At first, only small channels may be noticed on the surface after rain and these are easily obliterated by cultivation. With further rains, water accumulating in minor depressions breaks out and gradually opens up large gutters which are an obvious sign that valuable topsoil has been washed down the slope. At this stage, soil piles up along fence lines and tree roots are exposed. Tree vigour falls off rapidly and leader growth decreases from season to season until the trees are obviously unthrifty.

Where soil erosion is unchecked, the commercial life of an orchard is usually less than 20 years, which is about half the normal life of an orchard located on a reasonably fertile soil in the Granite Belt.

Soil erosion is directly responsible for some of the difficulties encountered in establishing orchards on replant land which has previously carried fruit trees. On such land the young trees have often to be grown either in subsoil or in a shallow layer of topsoil overlying the subsoil. Soil conservation practices help to solve this problem for the available topsoil is thrown up into contour banks before planting. Trees planted on these banks have a reasonable depth of topsoil in which to grow during the critical first 3 years of growth.

History

Before 1952, little or no attempt had been made to combat soil erosion on the steeper slopes of the Granite Belt. Some time elapsed therefore before the merits of various soil conservation practices could be assessed with any precision. No one knew for certain the best fall for contour drains in this type of soil. In early projects, an 0·5 per cent. fall (6 in. in 100 ft.) was used and this was sufficient to carry surface water away without scouring. However, within 3 years it was noted that ponding was taking place in some orchards with contour drains on an 0·5 per cent. slope. This caused water-logging between adjacent contour banks and interfered with spraying and cultivation operations.

In soil conservation projects carried out during the 1952-54 period, every third tree row was planted on a contour bank and the two rows between adjacent banks were planted on the flat. It soon became apparent that the trees planted on the banks were growing much faster than those on the flat between banks.

In 1954, soil conservation practice was modified to provide contour banks for each row of trees and a greater fall along the intervening drains. These modifications met with some opposition mainly because the banks made cross cultivation almost impossible. However, the advantages of the new layout were soon recognised. The weed growth between the trees on the banks was removed once a year and, contrary to expectations, cultivation over the banks did not pull much soil into the drains. Any lowering of the banks which did occur was easily remedied; the soil was thrown up to the trees with the back gang of the disc cultivator.

With a system of planting on contour banks, minor modifications have to be made in orchard practice. The trees must be planted deeper to allow for settling of the soil in the banks. Tree spacings have also to be adjusted. With increasing distances between banks, the trees are planted closer in the row so that each tree occupies approximately the same total surface area. In this way, the number of trees per acre is much the same as in the old style of orchard planting on the flat.

Trees are planted on banks with an 0·75 per cent. to 1·0 per cent. fall as against the original of 0·5 per cent. and spaced to give approximately 100 trees per acre.

Practice

The application of a soil conservation layout in the deciduous fruit orchard is very simple.

Once contact with the Department of Agriculture and Stock has been made by the grower, an officer visits the property, inspects the area which it is proposed to plant on the contour, and suggests an overall plan for the farm.

This ensures that the area which is to be contour planted can be extended without difficulty later on.

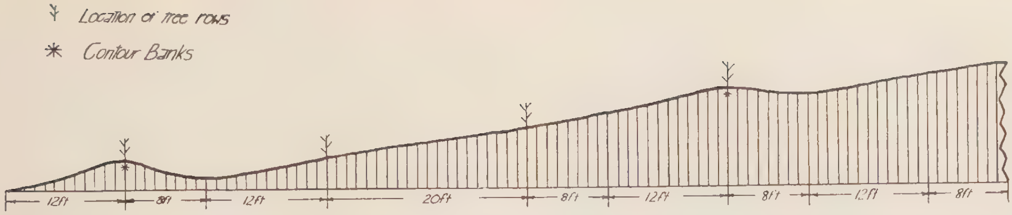
After discussing with the grower such matters as access tracks, waterways, slope, width between banks, methods of bank construction and general maintenance, detailed plans are drawn up and the work begins.

If a waterway is necessary, a suitable location is immediately pegged out. The surveyed waterway is then ploughed in such a way that soil from the middle is thrown towards the edg This is continued until a dish-shaped waterwa with solid banks and sufficient capacity to tak the run-off from the area it serves has bee constructed.

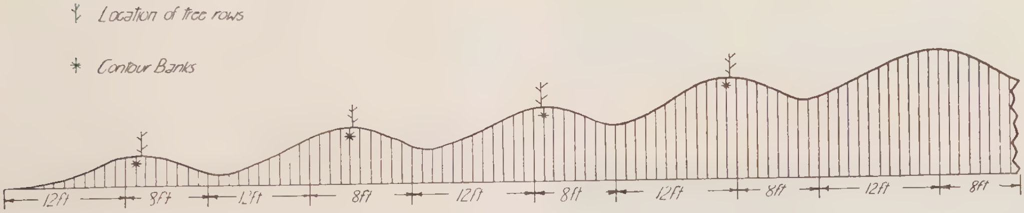
Plate 1 (Top): **The Tragedy of Soil Erosion in th Orchard.** Gully formation of the type illustrate indicates that substantial amounts of valuable to soil are being lost from cultivated areas.

Plate 2 (Bottom): **Apple Trees Planted on Contou Banks.** Trees planted on these banks make bett growth than trees on the flat. Surface water flow along the inter-row drains to waterways leadi from the cultivated area.

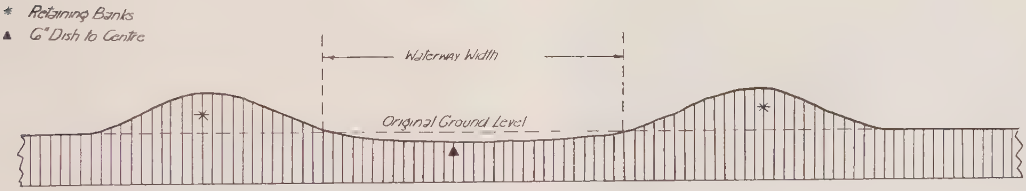
A sod cover containing phalaris (1 lb.), rye grass (1 lb.), Rhodes grass (2 lb.), red clove (1 lb.), and white clover (1 lb.) is then plante in autumn on a well-prepared seedbed to which fertilizer mixture (4 cwt. of 5:13:5 or simila mixture) suitable for pastures has been applie in the later stages of land preparation. Th waterway should be constructed and grasse before contour banks for the trees are throw up. This is to minimise the risk of erosion i the waterway when run-off water from the inter row drains is let into it.


Location of tree rows
Contour Banks
12ft
8ft
12ft
20ft
8ft
12ft
8ft
12ft
8ft

Cross Section 6% Slope


Location of tree rows
Contour Banks
12ft
8ft
12ft
8ft
12ft
8ft
12ft
8ft
12ft
8ft

Cross Section 6% Slope


Retaining Banks
6" Dish to Centre
Waterway Width
Original Ground Level

Cross Section of Waterway

Plate 3: **Diagrammatic Cross Section of Contoured Orchards.** (Top) Contour practice before 1954 with a contour bank in every third tree row; (Centre) Contour practice to-day with contoured banks for each tree row to increase soil depth below the trees and improve inter-row drainage; (Bottom) Typical waterway to carry run-off from the cultivated area.

A dumpy level and staff are used to establish the line of the bank. Each bank is marked out in 50 ft. lengths with a 1 per cent. fall. In practice each third bank is surveyed and made 60 ft. apart in the case of pome fruits. A furrow is ploughed along the line of the pegs in the surveyed bank position. The lines for the two intermediate banks are fitted in by direct measurement, pegged and also defined by a plough furrow. Construction of the contour banks then begins.

A crown is ploughed up onto the contour line over an area equivalent to the base of the bank, and this crown is further raised by a second ploughing. If a good implement is used, this is usually sufficient to produce banks of the required height of 18 in. above the inter-row drain. On land with slopes in excess of 8 per cent., a third ploughing may be necessary.

The same general procedure applies in the contouring of land for grapes. In this crop, however, the rows and consequently the contour banks are necessarily closer (10–12 ft.). If the banks have any appreciable curve, some difficulty may be experienced when straining wires on the trellis but this is not insurmountable. A few years after the vines are established on contour banks, the vineyard takes on a bench terrace appearance with normal cultivation between the rows.

Plate 4 (Top): **Waterway Constructed in Newly-Cleared Land.** The waterway is stabilized with a grass cover before planting with fruit trees.

Plate 5 (Bottom): **Grape Vines Planted on Contour Banks in Hilly Country.** Inter-row cultivation after establishment gives the area a "bench terrace" appearance.

When the contour banks have settled down after construction, there may be odd high and low areas in the inter-row drains between them. These should be marked out after the first rains and corrected as soon as possible. Subsequent maintenance of the banks is simple. All waterways, drains and outlets into waterways must be kept clear and the waterways themselves must be mown periodically.

The expense of laying out an orchard on the contour is equivalent to that of ploughing the land three times. Maintenance costs are about the same as in non-contoured orchards. Methods of inter-row cultivation are, however, designed to throw up onto the bank any soil that has been washed down into the drains.

Results

It is too early yet to give an accurate appraisal of the effect of contour bank planting on either production or longevity of the trees in deciduous fruit orchards; the existing contoured orchards are still relatively young. However, trees planted on contour banks have made excellent early growth and maintain their lead over orchards planted on the flat under much the same conditions. In some instances, the trees on contour banks are more than twice the size of those on the flat.

Little erosion has occurred in contoured orchards. Many growers have been so impressed by the results obtained that all subsequent plantings on their properties have been established in conformity with the principles of soil conservation.

Soil conservation may provide a partial solution to the problem of poor tree growth in replant orchards. One of the major causes of failure in replant orchards is the lack of sufficient top soil for the development of an adequate root system by the tree. When trees are planted on contour banks, the soil is concentrated where the young tree can effectively use it. Moreover, the exposed subsoil in the inter-row drains can be gradually improved to a point where it may be exploited by the tree when it comes into bearing.

The Granite Belt holds a great potential for soil conservation. Approximately 20,000 acres are under orchard and vine crops and a fair percentage of this area is due for replanting within the next decade. In addition there are about 12,000 acres of virgin land in the district suitable for cropping. Most of this should be farmed on the contour system.

The 250 acres already under contour demonstrate beyond question the benefits obtained from soil conservation. Its contribution to efficient land use and stable farming is such that growers are becoming increasingly conscious of the fact that contour planting of slopes is an essential for the future welfare of the fruit industry in the Stanthorpe district.

Harvesting And Flue-Curing Tobacco

By E. J. McDONALD, Senior Adviser In Agriculture.

The principles of harvesting and flue-curing tobacco leaf are outlined in this article so that, understanding them, the grower can decide by his own experience the minor variations he has to make on each occasion.

The aim in flue-curing tobacco is to preserve or fix the desirable qualities in ripe leaf. This is done by harvesting the leaf as it approaches maturity, completing the ripening process in a kiln or barn and then quickly removing the excess moisture. The farmer must know when the leaf is ready for picking, and how to control the ventilation and heat applied to the barn to cure the leaf successfully.

The outward signs of approaching ripeness in tobacco leaf, and the stage at which leaves should be harvested, vary according to the position of the leaf on the plant and the manner in which the crop has been grown.

The processes of harvesting and ripening a tobacco leaf are somewhat similar to the same processes in a bunch of bananas. A bunch of bananas begins to ripen at one end and ripening extends gradually towards the other end. If left on the plant, the first fruit to mature will be overripe before the last is ready to eat. For market, they must be harvested as a bunch before any of the bananas are completely ripe, and the ripening process in the whole bunch is quickened by holding it in gas in an airtight room.

A tobacco leaf starts to ripen at the tip and edges, and ripening extends backwards and inwards towards the butt and midrib of the leaf. Ripening proceeds more quickly than in the bunch of bananas, the various portions of the leaf being comparatively less bulky. If the leaf is left on the plant, the first portions to mature are dead before the last are ripe. To preserve the whole leaf, it must be harvested before any part becomes fully ripe. Ripening is quickened by holding the leaf in a closed barn at a favourable temperature in very humid air. This provides ideal ripening conditions.

If the harvesting of the bunch of bananas or of the tobacco leaf is delayed beyond the correct stage, some portions will become overripe during the induced ripening period. If either is harvested too soon, some portions will remain immature. The colour of ripe fruit or leaf may be reproduced but the typical flavour of the fruit or the smoking quality of the leaf will be absent. The more immature each is at harvest, the less desirable is the final product. Grossly immature tobacco leaf will remain immature and retain much of its green colour.

Signs of Ripening

As ripening approaches, the colour of tobacco leaf changes from a glossy green to a dull green and then starts to become yellow. The midrib changes from green to pearly white and the hairs on the midrib lose their stiff erect appearance and are more difficult to see. These outward signs become more noticeable as the leaf ripens and are a very good guide to the stage at which the leaf should be picked.

Lugs, from the bottom of the plant, are the oldest leaves and are thin-bodied. They can be harvested at an apparently earlier stage of ripeness than heavier leaf from higher up the plant. A week or so after the plant flowers, it will be noticed that these bottom leaves change to a dull green colour. They should then be picked if they are to retain their weight, bright colour and quality after curing.

When lugs become yellow before picking, they will perish before their colour can be fixed, and will cure as trashy leaf.

The second picking can usually be made at the same stage of ripeness as the former, but from then on, more and more definite signs of ripeness should be seen before the leaf is picked. Yellowness should be more pronounced and more of the midrib should be pearly white. This white colour should extend right along the midrib of leaves on the top half of the plant before harvesting.

Picking the last three leaves should be delayed until the top one is definitely ripe, otherwise these leaves are of little value when cured.

Rate of Ripening

Tobacco leaves ripen progressively from the bottom of the plant to the top, but at any one time during picking, two or three leaves on a plant will have reached about the same stage of maturity. These leaves can be cured together successfully, but picking too many leaves at once must result in uneven curing. Some will lose value and weight through overripeness or some will cure partly immature. Therefore, it is always preferable to make two light pickings rather than one heavy one. This simplifies curing and yields better quality leaf.

Plate 1: A load of slings ready for transport to the barn. A larger hessian cover cover should be used to prevent the bundles drying too rapidly

Plate 2: These racks are being used to hold freshly strung leaf prior to filling the barn. They are also useful when unloading the barn.

Leaf will ripen more slowly in a heavy crop than in a light one. In the heavy crop there should be more definite signs of ripening before starting each pick. Great care is necessary with the first two or three picks so that the leaf is not allowed to become overripe. The leaves will be large, but old and thin, much sunlight having been excluded from them by the larger plant They should be picked when they are definitely dull green but showing only a slight tinge o yellow.

Some varieties which have a natural light green colour throughout their growing period, such as Virginia Gold, demand extra care when picking The pearly whiteness of the midrib should extend almost the length of the leaf before harvesting

Leaves from plants which have made poor growth due to shortage of nitrogen are often pale n colour and their midrib white. This should not be confused with the pearly whiteness of ripe eaf.

When the appropriate stage of maturity has been reached, each tobacco leaf is harvested eparately by hand by snapping it off at the stem. After picking, the leaf should be placed on a tretcher or bag and protected from the direct heat of the sun, or it will scald, die and fail to cure. The leaf should be taken into the stringing hed as soon as practicable to avoid overheating.

Stringing

Harvested leaf is hung on "stringing sticks" before being placed in the barn for curing. These ticks are about 1 in. in diameter and 4 ft. 3 in. ong. They may be made from sawn timber, but mall bush saplings will serve. Care in stringing obacco is essential. The leaves should be tied n twos or threes on alternate sides of the stick with about 25 small bundles on each side. The eaves should be firmly held with a half hitch f string about three-quarters of an inch from he butts of the leaves. The string is securely knotted at each end of the stick to prevent leaves alling as they shrink in curing.

Packing the Barn

The practice of jamming too many leaves on a tick, a temptation when barn space is inadeuate, will hinder even and rapid drying of the eaf by restricting air circulation. This may ause a disease known as barn rot in which the eaf midribs turn black and collapse.

The sticks must be evenly placed 8 to 9 in. part on the tier poles in the barn to allow for he proper circulation of air. They should also e packed evenly across the barn so that the eated air meets their resistance as it rises and preads out evenly. If there is less leaf in the middle of the barn than at the sides, there is ss resistance to the air at this point and the af dries out more quickly than it does in the orners and sides. These latter portions, thereore, take longer to dry, thus causing greater xpense and loss of time.

Plate 3: Filling the barn.

The same process is used for curing leaf from all parts of the plant, but the time the leaf is held at the various stages differs according to the nature of the leaf and the existing weather conditions.

Curing Stages

The leaf passes through three stages in curing, but changes from stage to stage are gradual, not abrupt. The stages are: 1, colouring the leaf; 2, killing the leaf; and 3, completely drying the leaf.

In stage 1 the leaf is brought close to full ripeness by holding it in a closed barn in very moist air at a favourable temperature.

During stage 2, heat is used to drive moisture from the leaf which only just reaches full ripeness before being killed by the process.

In stage 3 the main veins and midrib are dried out completely to preserve those desirable qualities the leaf attained only as it became fully ripe.

Plate 4: Large liquid fuel burners.

A brief description of curing follows:

Stage 1. (*a*) As soon as the barn is filled, close all ventilators and the door, and light a small fire to raise the temperature to 90 deg. F.

(*b*) Raise the barn temperature slowly from 90 to 100 deg. with a very high humidity (wet bulb reading about 3 deg. below the dry bulb, or 90 per cent. humidity). When three-quarters of the leaf is yellow, that is, all yellow except for small green areas along the midrib and main veins, pass to the next stage.

Stage 2. (*a*) Open the top vents about half way and increase the heat slightly, thereby raising the temperature between 105 and 110 deg., and keep the wet bulb reading between 95 and 100 deg. This wet bulb reading should be maintained by manipulating the ventilation until the leaf is a lemon-yellow colour.

(*b*) Increase the heat and manipulate top and bottom ventilation to maintain the wet bulb reading between 95 and 100 deg. The dry bulb temperature will gradually rise as the moisture is removed from the leaf.

(*c*) Increase the ventilation at any time if the wet bulb reading rises above 100 deg. If this is impossible, the ventilators being fully open, decrease the heat until the wet bulb reading falls below 100 deg.

(*d*) If the wet bulb reading falls below 9 deg., increase the heat, or decrease the ventilation if the heating cannot be increased.

(*e*) When the dry bulb temperature has rise to 130 or 135 deg., the web of the leaf will b dry.

Stage 3. (*a*) As almost the total moisture ha now been withdrawn from the leaf, close th ventilators to reduce fuel consumption.

(*b*) If the wet bulb reading rises, there is stil too much moisture in the leaf, so the top ventilators must be reopened for an hour or so.

(*c*) The dry bulb temperature should not ris above 160-170 deg. for heavy bodied leaf—an should be held at this until all the midribs are s dry that they will snap when bent.

(*d*) The heat is turned off and the bar allowed to cool.

Watch These Factors

It will be apparent that the most importan factor in flue-curing is the humidity or wate content of the air in the barn. In stage 1, a high water content is essential but later there mus be a gradual reduction of humidity within th barn. The regulation of heat and ventilatio determines the rate at which the moisture i reduced.

Thirty years ago the importance of controllin barn humidity was widely recognised, particularl in the early part of stage 2. More recently mos farmers have attempted to guess at the humidit and have relied mainly on gradually raising th temperature within the barn. This neglect o one aid to effective curing has often resulted i lower quality cured leaf—because the guesswor was inaccurate. The air temperature within th barn tells only part of the story. It gives n indication of the rate at which the leaf is dryin from time to time. For this, variations in th humidity of the air must be known, as is clearl shown in a description of what actually happen to the leaf during curing.

After harvest, the leaf continues to ripen as i is still alive. Ripening will continue while th leaf contains sufficient moisture, but each portion of the leaf dies very soon after it becomes ripe Therefore, to save the whole leaf, ripening i accelerated artificially by holding the leaf in a very humid atmosphere at a temperature of 90 to 100 deg. F. and 90 per cent. humidity (wet bulb 3 deg. below dry bulb reading). There is generally sufficient moisture in the leaves to provide this humidity, but if not, wet bags are kept on the floor of the barn until the required reading is attained.

The ripening process must be arrested by removing moisture from the leaf at a stage when the desirable qualities are at a maximum, or the leaf will continue vital changes until death intervenes. It takes time to reduce moisture enough to stop ripening, so the process is started when the leaf is about three-quarters yellow. The leaf then ripens completely just as the moisture is depressed to the level at which the leaf dies.

The moisture is expelled from the leaf during stage 2 by applying heat, and is removed from the barn with the heated air rising from the bottom to the top of the barn. Heated air must rise, so if ventilators are opened at the base of the barn a stream of air will rise up through the barn and out of the top ventilators, carrying with it the evaporated moisture which has been removed from the leaf.

The degree of heat applied and the volume of air circulated through the barn are balanced to effect a gradual reduction of moisture in the leaf. If there is too much heat and not enough air circulation, moisture is drawn from the leaf but remains in the barn to condense on the leaves and cause a discolouration known as sponging. This darkens the leaf and reduces its value. If there is too much air circulating for the heat applied, the leaf dries out too quickly, and retains some of its green colour, because it is killed by lack of moisture before becoming fully ripe.

It is essential to ensure, by measurement, that there is a gradual reduction in the moisture content of the air in the barn during curing, to ensure that the moisture is being withdrawn from the leaf and is being carried away. Measurement is either by wet and dry bulb thermometers or by a hygrometer.

The air is dried by processes which have the effect of increasing the dry bulb temperature while holding the wet bulb constant. Fuel is saved and the barn can be used more often if each curing is done in the minimum possible time. Therefore, the maximum heat and ventilation should be used, provided the constant wet bulb reading is maintained. The only skill required is to find, by gradually increasing both of them, the maximum amount of heat and ventilation which can be used.

Most of the first heat is used to expel moisture from the leaf. Later, more heat is available to raise the air temperature and so the dry bulb reading will rise.

When using a hygrometer in conjunction with a dry bulb thermometer, there should be a gradual fall in the reading of the first instrument, which records the relative humidity in the air at the temperature when read. Table 1 in this paper shows appropriate hygrometer readings for various barn temperatures used in curing. Progress will be satisfactory if the hygrometer reading is within the limits opposite the appropriate dry bulb reading.

When stage 3 of curing approaches, most of the moisture has been removed from the web of the leaf, but much remains in the midrib and larger veins. To remove this quickly, the heat is increased and the ventilation reduced. The top ventilators should not be closed entirely as there is always some moisture to be removed, and closing them completely would impart an undesirable odour to the tobacco leaf.

At the completion of stage 3 in curing, the ventilators and door are opened. This will enable the leaf to take up sufficient moisture during the following night to allow the barn to be unloaded. The leaf is removed when there is just sufficient moisture or condition in it to allow handling without breakage.

The general principles apply to every cure, but several factors influence the times taken for the leaf to pass through the three stages. Attempts to hasten curing by over-heating will lead to lower-quality leaf and very often cause barn fires, particularly where flue pipes are in use. The increased heat may cause weak spots in the pipes to burn out and allow the flames to enter the barn. Some of the factors causing variation in curing times are:

1. *Fullness of barn.* The greater the quantity of leaf packed into a barn the greater resistance to the circulation of air in that barn, and the greater the quantity of moisture to be removed. Therefore, the drying period is longer and the rise in temperature is slower. The situation is

met by strict application of the change from stage 1 to stage 2 in curing.

2. *Uneven maturity*. If too many leaves have been harvested from individual plants, there will be uneven ripening in stage 1 and some leaf will probably become overripe. Suffer this, but keep the quantity of immature leaf as low as possible. If harvesting has extended over two days, the freshest leaf should be placed at the top of the barn so that it has a longer time to ripen. If leaves have been harvested from different plantings, the heavier leaf should be placed at the top of the barn.

3. *Nature of leaf*. Lugs and thin leaf will ripen and dry much more quickly than heavier bodied leaf. The latter will be more inclined to sponge.

4. *Weather Conditions*. In wet, windy or cool weather, less bottom ventilation will be needed to maintain the constant wet bulb reading. Probably, increased heat will also be needed as part will be used in drying or warming the incoming air.

5. *Opening the Door*. Opening the door causes a rush of cool air into the barn. It is better to have a glass window or a small closing peep-hole in the upper part of the door, through which the thermometers may be read. After the desired colour has been attained, there is very little need to open the door.

6. *Heating Systems*. In recent years, the oil burner has largely replaced the wood fire as a means of heating tobacco barns. Oil burners can be regulated more closely and therefore supply a more constant heat. It is particularly important to keep them clean so as to obtain the maximum benefit from the fuel.

Pot type burners should be level and evenly spaced within the barn. Two or four burners are necessary; three cannot be arranged to supply an even heat. Bottom ventilation should be directed on to the middle of each pot.

The use of a wet bulb thermometer or a hygrometer is particularly necessary with controlled temperature burners set to maintain a given temperature within the barn. A wet bulb thermometer shows whether circulation is effective for the heat being applied. As this type of burner heats a system of flue pipes within the barn, these pipes should have a gradual rise throughout their length to provide even heat to the front and rear of the barn and be level across the barn to heat each side evenly, as with wood burners.

Moisture Measuring

The wet bulb thermometer is the most important instrument because its reading is used to regulate the amount of heat applied and the quantity of air circulated through the barn. It must give a true reading if heat and ventilation are to be adjusted correctly.

A thermometer with a dirty wick will be inefficient, therefore the wick should be washed in warm, soapy water and rinsed in clean water before being used in each barn.

The bowl should be kept full of clean water, preferably distilled, and topped up every day to reduce the draw on the wick. At the temperatures used during curing, there is a good deal of evaporation and at times the wick may dry out around the bulb, so whenever the reading is unexpectedly high always check to make sure the wick is wet.

During colouring or stage 1, keep the wet bulb reading about 3 deg. lower than the dry bulb. If the difference is less than 3 deg., open the top ventilators, or if more, place wet bags on the floor of the barn.

In stage 2, maintain the wet bulb reading at between 95 and 100 deg., gradually increasing the heat. If the wet bulb rises above 100 deg., increase the ventilation. Top ventilation should be fully opened as soon as possible and then any further increase is made on the bottom ventilation. If the ventilation is fully open and the wet bulb does not fall, decrease the heat until the wet bulb returns to normal. These adjustments should be made as quickly as possible, as soon as full colour is obtained in the leaf, provided the wet bulb reading stays within its correct limits.

In stage 3, decrease the ventilation unless the wet bulb rises above 100 deg. If it does so rise, open the top ventilators for an hour or so and then partly close them.

The hygrometer is an instrument which records the relative humidity of the air in the barn. It may be used in place of the wet bulb thermometer to record the variations in relative humidity as curing proceeds.

During colouring, the hygrometer reading is kept at 90, and during stages 2 and 3 of curing, the reading should slowly decrease. This is effected by continually increasing the heat and ventilation applied to the barn until the web of the leaf is dry, and then decreasing the ventilation.

The following indicates how the hygrometer is read in conjunction with the dry bulb thermometer:

If the hygrometer reading is within the limits shown opposite the dry bulb reading in Table 1, then the leaf is drying at a satisfactory rate. If the hygrometer reading is above the upper limit shown in the table, the moisture content of the air within the barn is too high. Increase the ventilation, or if the ventilators are already fully open, decrease the heat. If the hygrometer reading is below the lower limit, the air is drying out too quickly. Increase the heat, or if this is not possible, decrease the ventilation.

TABLE 1

RELATION BETWEEN DRY BULB AND HYGROMETER READINGS

Dry Bulb	Hygrometer	
	Not Below	Not Above
100	85	90
105	70	80
110	60	70
115	50	60
120	40	50
125	35	40
130	30	35
135	25	30
140	20	25
145	15	20
150	10	15

This article outlines the principles of harvesting and flue-curing tobacco leaf. If he understands these principles, which provide the reasoning behind the various operations, a grower can quickly decide, by his own experience, the minor variations which he has to make on each occasion. Advice can always be obtained from district advisers of the Department of Agriculture and Stock.

Master Your Motor Mower

From suburban lawns, motor mowers have moved into the country. Many farmers these days use motor mowers to keep down grass and weeds around buildings and hay stacks. They're proving their worth, too, but here's a word of warning: Play safe with these machines; they can be dangerous.

Keep children, pets and farm livestock out of range of flying sticks and stones. A hit in the eye could cause blindness.

Always take off the lead to the spark plug before checking the cutter blades. Remember, if you pull the disc holding the blades round by hand you could kick the motor over—and perhaps lose a finger, or at least get a nasty cut.

For the same reason, always stop the mower before fitting a shield or a catcher.

Do you find the motor difficult to start sometimes?

Never tip the machine over when the carburettor's full. This causes flooding, which always makes starting difficult.

Clean the soot out of the silencer regularly, and make sure the exhaust doesn't get clogged with grass.

And of course, keep the spark plug clean and set with the correct gap between the points.

—*A. E. FISHER, Agricultural Journalist.*

Cavendish Or Mons Mari ?

By J. A. MOBBS,
Adviser in Horticulture.

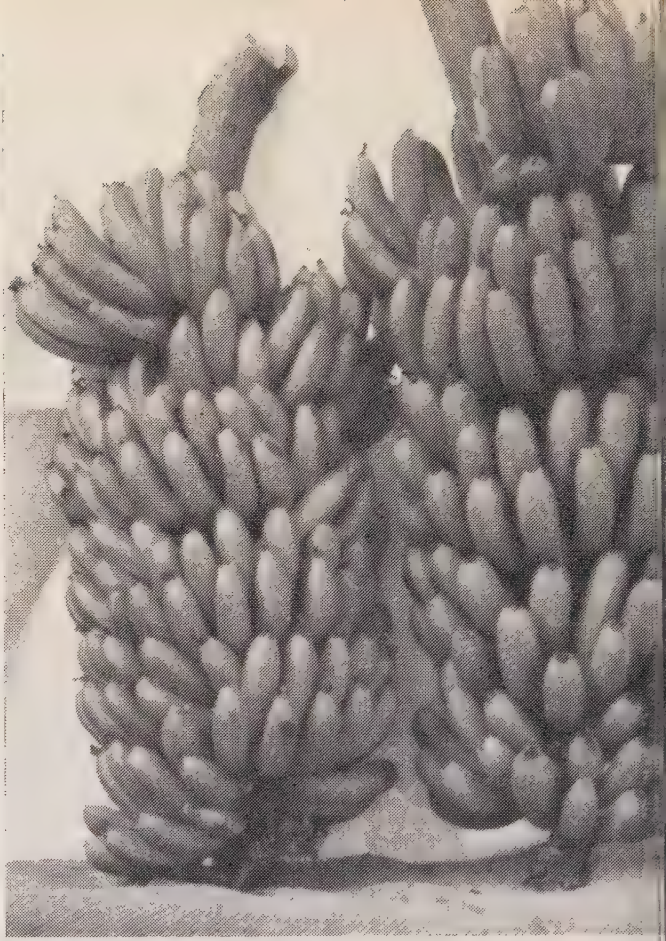


Plate 1: **Dwarf Cavendish bunch (Left), Mons Mari bunch (Right).** Note the widely separated hands and cylindrical shape of the Mons Mari bunch.

The merits of the Dwarf Cavendish banana are compared with those of the Mons Mari, which is now preferred on all but the most fertile land.

The Mons Mari banana is more tolerant of adverse conditions than Dwarf Cavendish, particularly in relation to soils, climate and exposure, with the result that it is steadily displacing Cavendish in most banana-growing districts. On the Lower North Coast the acreage of Mons Mari is now double that of Cavendish.

The Dwarf Cavendish was the first banana variety to be grown commercially in Queensland. Its popularity was unquestioned for many years and until comparatively recent years the banana industry was mainly dependent upon it. As expansion took place, however, the more favoured, fertile and sheltered areas, particularly those carrying rain-forest vegetation, gradually became exhausted, and spent plantations were converted to pasture for dairying.

At the present time, the majority of our bananas in southern Queensland are being grown on replant land or on open forest soils which are less favourable than the rain-forest areas.

Although the Dwarf Cavendish in many instances does quite well on these soils, it is more exacting in its requirements than Mons Mari. The latter has proved superior when grown on replant land, and there is a growing tendency for growers to favour it in preference to Cavendish. Both varieties are susceptible to frost damage and their growth can be severely checked by chilling. Consequently, even if Mons

Plate 2: **Dwarf Cavendish.** Note the low stature and sturdy appearance of the plant, requiring only a single prop.

Plate 3: **Mons Mari.** This is taller and more slender than the Dwarf Cavendish. Note the double prop required.

Mari is to be grown, sites cannot be chosen aphazardly, and prospective growers would be vell advised to seek information from local ources before committing themselves to a articular area.

Dwarf Cavendish

The Dwarf Cavendish (Plate 2), as its name mplies, has a dwarf habit of growth, its heavily igmented pseudostem averaging only 5 to ft. in height. When grown under favourable onditions, the bunch tapers somewhat and the ruit are only slightly curved. The hands are losely spaced on the bunch stalk, and the mature unch is very compact (Plate 1). Bunch size aries considerably but, in a well managed lantation, a conservative estimate would be an verage of eight to 10 hands to the bunch.

This variety retains considerable popularity in some districts, growers regarding its low stature as an advantage for the following reasons:

(1) The plants offer less resistance to winds and are, therefore, less liable to damage from storms or cyclones.

(2) The plants are much easier to prop than taller varieties.

(3) If bunch covers are used, they can be fitted with a minimum of effort.

(4) Leaf symptoms of bunchy top are more easily detected in the early stages of the development of the disease.

(5) Where sprays are required for the control of diseases and pests, they can be applied more effectively, and the operation is less costly.

These advantages are offset to a large extent by the fact that Cavendish is more subject to choke-throat than Mons Mari. This condition is usually associated with dry weather and, in extreme cases, may result in considerable loss of production. It is attributed to lack of vigour, as a result of which the bunch, instead of being thrown clear of the throat to hang normally, does not clear the pseudostem. The only remedy is to release the bunch by breaking down some of the leaves, but even so it is usually deformed and many of the fruit on the under part are badly misshapen and fail to mature normally.

Mons Mari

The Mons Mari is a sport from the Dwarf Cavendish and is reputed to have been discovered at Buderim some 50 years ago. A similar, and probably identical, sport known as Williams's Hybrid, and presumed to have originated in Fiji, is grown extensively in northern New South Wales. As previously mentioned, the acreage under Mons Mari on the North Coast is double that of Cavendish. This preference is attributable to the better results obtained on the poorer forest soils and on land that has previously grown bananas.

This variety (Plate 3) is much taller than the Dwarf Cavendish and, under favourable conditions, may grow to 12 ft. The pseudostem is more slender, but the general colour of the foliage and pigmentation of the pseudostem is very similar to that of the Cavendish. The bunch stalk is longer and enables the upper hands to hang clear of the foliage.

This feature is a distinct asset in that it favour more uniform maturity in the hands.

The bunch is more cylindrical, and the hand more widely separated than in the Cavendis (Plate 1). The individual fruit are distinctl curved and fairly uniform in size. In addition t producing a more attractive product for the bunc trade, this facilitates grading and packing.

In bearing plantations, Mons Mari is readil distinguished from Dwarf Cavendish chiefly by it height and bunch characteristics. Its main advan tages are:

(1) It is less prone to choke-throat unde unfavourable weather conditions, whic would cause considerable loss i Cavendish.

(2) It grows more satisfactorily at highe altitudes than Cavendish.

Because of its more slender pseudostem requires additional support to prevent its collaps ing under the weight of the bunch. It is essentia to provide two props, whereas one is frequentl sufficient for Cavendish. Because of its heigh bunch covering to protect fruit is more awkwar and takes longer.

When grown under similar conditions, Mon Mari will usually outyield Dwarf Cavendish and i better able to withstand more difficult growin conditions. Taking everything into consideratio Mons Mari is generally preferred on all but t most fertile land.

Tinaroo Glycine

The strain of *Glycine javanica* now being widely grown in northern Queensland has been named "Tinaroo glycine" to aid identification and to avoid confusion with other strains which are being developed. The strain originated from seed introduced from Kenya, South Africa, in 1945.

Bulk seed production commenced in 1959, and 1½ tons of seed have now been distributed. Further seed from the 1961 crop will be distributed to farmers.

Other strains of glycine, especially early season varieties which will seed before frosts occur in southern areas of the State, are now being developed.

The strain which has been developed i northern Queensland was studied at severa experiment stations, particularly at the Bureau o Tropical Agriculture, South Johnstone, and a Regional Experiment Stations at Ayr, Millaro and Kairi. Early seed production was under taken at Ayr and Millaroo, but the bulk of th commercial material has originated from see areas established at Kairi.

Information on the performance of this strai was given previously in articles published in th *Queensland Agricultural Journal* in May, July August and November 1960, and February, 1961

—*G. H. ALLEN, Senior Agronomist.*

Hints For The Young Overseer

By Officers of Sheep and Wool Branch.

Here in brief, for young overseers and managers of Queensland sheep stations, are some pointers on various interests that lie within the compass of their work. It is emphasised that many of these are not necessarily the major points of management, but ones that through seeming to be of somewhat lesser importance, might be regrettably overlooked.

It is suggested that the reader should score one point for each of the things that he is already doing. If your score is 50 you can give yourself a pat on the back; if you get less than 25 it might safely be said that you have now picked up a few good hints.

Improvements

Have property name on homestead roof for aircraft identification.

Fire-plough long grass growing close to shearers' accommodation and outbuildings as fire precaution.

Tighten loose nuts on windmills.

Have stocks of replacement piping, fittings, pump casing and pump buckets.

Clean out roof gutterings and tank strainers before the rain season.

Whitewash or paint shearing shed roofs and exteriors for coolness.

Whitewash shearing board and catching pen frontages to improve indirect lighting in shed.

Nail down loose nails on all roofs, and on woolshed floors and pens.

Replace broken boards and battens in woolshed floors.

Get rid of projections in sheep yards, forcing pens and races.

Clear rubbish off watercourse fences before the rainy season.

Stock

Check sheep for fly, worms, or ill-health whenever yarded or seen in paddocks.

Take out insurance against stock and fence losses from bush fires.

Move sheep out of channel country in flood months.

Plant shade trees at sheep yards and in treeless paddocks.

Water soil in yards at shearing time.

Handle all stock only in the cooler parts of the day.

Drench sheep slowly and carefully to avoid damage to mouths and throats.

Plate 1: **Fireplough Long Grass Growing Close to Shearers' Accommodation as Fire Precaution.**

Plate 2: **A Long-Horned Ram.** Cut back rams' horns to permit easy passage through races.

Avoid staining wool when using phenothiazine.

Cut back rams' horns to permit easy passage through races.

Check and trim overgrown hooves in ram and ewe flocks.

Check water facilities frequently in summer.

Fence off boggy patches in drying-back surfac waters.

Clean troughs frequently to ensure good wate for sheep.

Use commercial preparations, drenches, dip insecticides, strictly in accordance with maker dose and mixing rates.

Make sure employees wash and grease saddle reins, girths, surcingles, regularly; and wash ou saddle cloths frequently.

Provide fly veils for working horses in fly tim

Plant

Keep bulk petrol and fuel stocks under a roo to prevent water contamination and fuel evaporation.

Screw up drum caps tight after drawing fuel.

Have shadow boards with nails in toolshop f hanging tools, so that missing tools do not g unnoted.

Check all tools into vehicle before leaving a outside job.

Have spare spark plugs for all engines.

Carry pull-out gear, wheel chains, and shovel i vehicle during wet season.

Safety

Get in reserve supplies of rations, stores, fuel insecticides, before the flood season.

Keep fire-fighting plant in instant readiness.

Keep buckets of sand in vehicle shed, engin room, and fuel depot for fire precaution.

Keep poisons away from children in a locke poison shed.

Don't carry poisons in saddle pouch or ca glove box.

Keep dogs on chain or muzzled during pa dock poisoning campaigns.

Teach dogs not to run at cars, and chain c kennel all dogs at night time.

Don't allow loose dogs at killing pens, offal may contain hydatids.

Don't climb through fences with loaded firearms.

Unload firearms before entering a vehicle, and remember the "offside rule" is more important when using firearms than in football—don't shoot with people in front of you.

Wash hands frequently when using insecticides.

Keep a first-aid kit at homestead and shearing shed.

Trim wicks of kerosene refrigerators weekly, make sure not to use power kerosene in refrigerators, and don't allow tinder-like debris to collect around fuel tank or behind refrigerators.

Do not replace blown fuses with other than fuse wire.

Put out camp fires with soil or sand before leaving camp.

Employees

Respect and trust your employees and they will trust and respect you.

Pleuro Campaign Starts Well

The Agriculture Department's long-term scheme to rid Queensland for ever of the costly cattle disease pleuropneumonia, made a very promising start in the cattle season ended in September. No outbreaks occurred in store cattle travelling throughout the State—even from far-flung areas like Boulia and Normanton.

Usually losses from all causes put the cost of pleuro to Queensland cattlemen at £750,000 a year.

The Minister for Agriculture and Forestry (Hon. O. O. Madsen, M.L.A.) said there had not been a single outbreak of pleuro in the 165,000 travelling store cattle in the season just ended. This was an indication of the efficiency of the supervised vaccination.

Of the travelling store cattle, more than 131,000 were inoculated under the direct supervision of Agriculture Department officers. The remaining 34,000 were inoculated by owners and agents where supervision would have caused unjustifiable delays.

During the year, examination of specimens from slaughtered cattle was continued both at meatworks and in the laboratory. Some cases of resolved lesions of pleuro were recorded at meatworks, but only three active cases were found. One of these came direct to the works from outside Queensland. Only one property was quarantined during the season, but preventive inoculation programmes were introduced at most other properties from which suspect cattle originated.

Special attention is being given to eradicating pleuro from properties on the fringe of the suspect area. The aim here is to eliminate pleuro from these districts and so extend the free area. In addition to examining the lungs of all cattle slaughtered from these areas, more than 3,000 blood samples were tested. Only one of these samples showed that the animal had had pleuro.

Although much of the effort this year was directed towards vaccinating travelling cattle, protection of cattle on the property was not neglected. With the help of the scheme's officers, cattle owners in suspect areas have begun to inoculate all their cattle on a scale never previously approached.

Mr. Madsen said the intensive drive against pleuro began early in April. It had now been reduced with the closing of the cattle season, but would start again next autumn. Most of the special staff allotted to the pleuro campaign had been transferred to other duties for the summer. But the inoculation campaign would be continued as required under the supervision of stock inspectors in the various districts.

Controlling The Mating of Dairy Stock

By S. E. PEGG, Chief Adviser, Herd Recording.

Who dictates the calving pattern on dairy farms? This is a question which each dairyman should ask himself. Is the time of calving and period between calving of the cows planned and controlled; or does the bull run with the herd and decide these matters himself?

If the bull is allowed to run with the herd the owner does not know with certainty when his cows are due to calve; neither will he be aware of returns to service or how frequently these occur. Without control, one of the diseases affecting fertility can be firmly established in the herd before the owner realises it.

Good management calls for the control of the bull, and to do this a separate bull paddock is essential. Such a paddock leads to the following advantages:

(*a*) Services are controlled and calving can be arranged for predetermined periods. This is particularly important where seasonal calving is desired, and in herds producing market milk where a regular supply of milk in the low-producing winter months is demanded.

(*b*) Service dates can be recorded. This enables calving dates to be known.

(*c*) Any return to service is noticed. This allows a check to be kept on the incidence of infertility.

(*d*) The vigour of the bull will be maintained by limiting the number of services.

(*e*) Reliable breeding records can be kept to form the basis for selection of breeding stock.

Farms with Bull Paddocks

In 1957, a survey of 866 farms in herd recording groups showed that only 43 per cent. of the farms were equipped with bull paddocks.

Another survey was conducted in March, 1961, to see if there was any change in the number of producers who provided bull paddocks. This showed that 56 per cent. of the 911 farms surveyed had bull paddocks. In each case the survey was restricted to members of herd recording groups.

This increase in the percentage of farms is significant. It would appear that more farmers are realising the value and necessity of controlling their bulls. When this analysis was prepared on a district basis, a wide range in district practices was evident. The following table reveals the extent of this difference:

TABLE 1

District	Number of Farms Surveyed	Number with Bull Paddocks	Percentage with Bull Paddocks
Atherton Tableland	28	9	32·1
Mackay	15	10	66·7
Central	44	18	40·9
Upper Burnett	22	15	68·2
Central Burnett	43	28	65·1
South Burnett	172	94	54·6
West Moreton	116	58	50·0
North Coast	183	149	81·4
South Coast	87	63	72·4
Eastern Downs	138	53	38·4
Western Downs	63	11	17·5
Total	911	508	55·8

Where the economics of production rest on regular lactations and adequate spelling of cows during their dry periods, the absence of a controlled breeding plan leaves too much to chance. One simple step towards greater control of production is the recording of services. This is possible only by control of the bull which is facilitated by the provision of a special mating area.

stock and station

Erysipelas in Pigs.—Erysipelas has become an ever-increasing menace to pig raisers. It affects their pockets through deaths and through poor growth rates and condemnation of legs and carcasses at bacon factories.

It is caused by a bacteria which can be septicaemic and cause rapid death. Sometimes, it is associated with red diamond skin lesions. However, in the less acute forms it lodges in the joints, causing arthritis, or in the heart, causing vegetative growths.

Yards in which the disease has occurred should be cleared of all rubbish and spelled. The pens should be cleansed and disinfected with hot caustic.

If you suspect the disease in your piggery, consult your veterinarian or stock inspector, who can take the necessary tests and advise you on antibiotic treatment or vaccination. A vaccine is now available and is given to piglets at weaning time. Breeding pigs need subsequent booster doses.

—S. G. KNOTT, Divisional Veterinary Officer.

Cannibalism In Range Chickens.—If you shut range chickens in their sheds during the day to vaccinate them, be sure they have plenty of food before them all the time. Failure to replenish the food supply in crowded colony sheds can lead to losses from cannibalism.

Recently, a poultry farmer experienced trouble from this source. He shut in his six colony sheds of range pullets for vaccinating. The birds in each shed were released when vaccinated. However, on vaccination of the last shed, dead and wounded chickens were found. Their food troughs were empty.

Although mash had been supplied to the other sheds early in the day, the sixth shed had been omitted.

From the flock of 400 pullets in this pen, 12 pullets showed severe wounds caused by tail pecking. Four of these were dead and three died soon after. On opening several of the birds, it was obvious that loss of blood was the immediate cause of death. There is no doubt that lack of food and the inevitable overcrowding in the colony shed led to cannibalism.

The cost to this farmer in dead birds (three-quarter grown) was as much as the cost of vaccinating this shed of 400 birds for I.L.T. and fowl pox.

If the vaccination had not been completed reasonably early, losses may have been greater.

It is the usual practice to house more chickens per floor area in colony sheds since the birds range out during the day. Hence overcrowding results if the birds are shut in during the day for vaccinating purposes.

However, this should be of no consequence provided one carries out the work in cool weather and supplies the chickens with plenty of food in sufficient trough space. Where food is lacking, one can only expect cannibalism by the hungry overcrowded birds.

—P. D. RANBY, Veterinary Officer.

Vitamin and Mineral Supplements.—Now that we are adding vitamin and mineral supplements to our poultry feeds instead of relying on green feeds and mill offals, it is felt that not sufficient care is being taken to mix these supplements through the rations. We often find poultrymen scattering the additive over a batch of mash. This does not give an even mix.

All vitamin and mineral supplements should be mixed with some other ingredient of a more bulky nature before they are put into the mash. This is the only way of ensuring that each bird gets its share of the supplement.

Another point to watch is that no lumps of salt or manganese get into the mash. Both these materials can prove to be toxic if they are eaten in small lumps. Fowls eat these lumps in their search for grit, and there have been reports of poisoning from this source.

—*C. A. R. MANNING, Senior Poultry Adviser*

Managing Pastures For High Yields

Long-lived and highly productive pastures don't come by accident. They are the result of careful management right from the pre-sowing treatment until the final ploughing out for replanting.

In agricultural and dairying districts pre-cropping land intended for pastures will help to ensure good pasture establishment. For pre-cropping, a summer crop is usually chosen so that the pasture can be replanted in the following April or May. Cowpeas or a mixture of cowpeas and white panicum are usually grown.

This crop not only provides excellent grazing, but also keeps weed growth in check. Furthermore, soil fertility is improved and the extra workings aerate the soil thoroughly. Once this crop has been grazed, the land is worked into a seedbed for planting.

In managing the established pastures, a pattern of grazing and spelling is ideal. For maximum yields, a pasture should never be grazed shorter than 4 to 5 in. in spring and 3 in. in winter.

Research work has shown that nitrogen is transferred from the clover to the soil through the decay of root nodules. As the soil takes up this nitrogen it becomes available to the grass. The nodules slough off the roots as part of the general plant growth and development pattern. This process is also accelerated by defoliation, either by mowing or grazing. In addition, grazing results in the return to the soil of considerable amounts of nitrogen in dung and urine. With regular grazing and spelling therefore a steady transfer of nitrogen takes place from the clover to the grass. The nodules build up during the spelling period, and die and decay as a result of grazing.

Both undergrazing and overspelling reduce productivity as the grasses shade the clover when they grow tall. When this happens, root development of the clover ceases and the nitrogen transfer is lost.

Moderate grazing makes another valuable contribution to the yield and longevity of the pasture. Work in Queensland has shown that an effective ground cover of pasture foliage provides good insulation in summer. This plays a big part in guarding the plants against killing soil temperatures in summer.

Readings at Theodore have shown that under a dense pasture cover, the soil temperature was 78 deg. F. The soil under a closely-grazed pasture was 121 deg. and on bare soil the temperature rose to 140 deg.

—*W. J. WHITE, Senior Adviser in Agriculture.*

When Buying Carpets

Carpeted floors are no longer a luxury only a privileged few can afford, but carpets are still expensive.

With wise selection and proper care carpets can be made to last a lifetime.

Let your choice be backed by the reputation of a trustworthy manufacturer.

Select a good underlay as this is by far the most valuable ally in prolonging carpet life.

Consider the kind of carpet best suited to your room.

Dark rooms look friendlier with warm-coloured floor coverings.

Sunny rooms in warmer climates look more refreshing when carpeted in cool colours. In cooler climates where sunshine is so valuable, selection of colours depends on the size of the room.

Big rooms will look cosier when carpeted in rich, dark background colours or small all-over pattern designs.

Small rooms will look more spacious if carpeted in close fitting (wall-to-wall) cooler colours.

Low ceilings can be made to appear higher if floors are carpeted in deeper shades in tone with lighter ceilings.

High ceilings can be visually lowered if floors are carpeted in a deeper shade in exact tonings with ceilings to contrast with light colour of walls.

Small homes and flats can be given a restful completeness when carpeted throughout in the same neutral shade.

Bright or printed wallpapers go well with plain carpets which tone in with or are in contrast to or highlight one colour of the design.

Active small children in a home require patterned carpet floors as these do not readily show up dirt marks and crumbs.

When buying carpets for stairs be guided by the general tips, but remember that stairs must stand up to constant flow of traffic, so choose the very best quality.

It is advisable, if the stairs are to be carpeted throughout, that the work be done by an expert.

Make sure that only the best quality and thickness of stair pads are used.

For those who like a carpet runner on their stairs it is prudent to buy solid good quality rods to hold the runner tightly in place.

Remember, when laying the runner, to leave an overlap of at least several inches at top and bottom of the stairs.

The carpet can then be moved slightly up or down three or four times a year to even out the wear and tear.

Slips And Petticoats

Unless half slips and petticoats are cut with regard for current styling of skirts the overall fashion line and appearance can be marred.

For this reason slip and petticoat styles change with fashion as they serve as a foundation for the silhouette.

The great variety of styles and fabrics now available make selecting the right slip and petticoat increasingly difficult.

Here are a few suggestions as a guide:—

The range of lingerie fabrics grows daily, and as many are of the easy-care drip-dry variety the careful hand washing of dainty garments is now not necessary.

Fabrics should be smooth and pleasant to touch. Check lace trim for this quality too, as a crisp lace can be irritating.

Unless fullness and some stiffness are required, supple fabrics are preferable.

For wearing under light, transparent or semi-transparent frocks, select the slip with the double or opaque centre panel.

Except with frocks made from transparent or semi-transparent fabrics when colour of slip should match, coloured underwear is a matter of personal preference.

One point worth knowing is that grey is a most useful colour for wear under many pastel-coloured summer fabrics.

A different coloured slip will often give depth and character to the dress fabric.

Irrespective of style or fabric the size should be correct.

The garment should fit smoothly over the bust and under the arms, and should be the right length to the waist.

There should be ample room to allow for movement—for sitting, walking and bending.

A slip should be about half an inch shorter than dress or skirt.

Straps should be fastened to the body of the slip, not just to the trim.

Seam finishes should be durable and not bulky.

Darts should be smoothly tapered and secured at the points, and trimmings should be strong enough to last the lifetime of the garment.

Information about the fabric, special finishes, and proper care will be given on tags and labels, therefore read these with care and keep for reference if necessary.

Air Fresheners

Have you gasped for air in a room full of people, where all the windows are closed? Have you ever walked into a room filled with smoke, or into a house where cabbage or fish was being cooked? If you have, did you wish something had been done about it?

You can avoid those situations in your own home by using a variety of the air fresheners sold on the market today.

These, whether spray, cake or wick type, are specially produced to camouflage and absorb unpleasant odours in kitchen, living room, bedroom, nursery and bathroom.

The spray variety comes in a metal container with a push button release of fine, misty spray.

It is more expensive than other varieties but its effectiveness in quickly dissipating stale and unpleasant odours is worth its expense in a home.

It is handy in the bathroom, toilet, kitchen (if you have time to spray during cooking), in rooms where kitchen odours permeate, and certainly very useful after smokers and in the sick room.

The wick-in-bottle type freshener is easy to use and is also a very useful item to keep in the home.

Simply uncap the bottle to pull out the wick. Use it in the kitchen before, and during cooking of fish, cabbage, onions or other strong-smelling foods, or place it discreetly behind a vase or an ornament in a room where you will entertain smokers or visitors who do not like open windows.

It can also be left in the sick room to absorb medicinal smells and stale air.

The cake variety with a distinct pleasant smell of its own, is covered with fine celophane paper and can be bought with a special plastic container which can be refilled.

The cake air freshener, used on a continuous basis, is particularly effective for separate indoor or outdoor toilet facilities.

It may be placed in its container or simply left with part of its wrapping removed.

As a general rule, nothing can take the place of clean fresh air.

But when odours are strong, and permeate the whole atmosphere—even furnishings and clothes—and the air gets stale or musty, effective use of air fresheners can make the atmosphere around your house much more pleasant.

Colours for Safety

Red is the strongest of the "advancing" group of colours, so it is easy to understand why it was selected as a danger colour—we see it sooner than other colours.

Everyone is familiar with the signals red for "stop" and green for "go", interpreting them in colours as red for "danger" and green for "all clear".

You can make practical use of this "hit you in the eye" characteristic of bright colours for children's clothing.

These colours provide a margin of safety, that extra fraction of a second warning, which can spell the difference between life and death when a child runs, unthinking, on to the road or in front of the tractor, after a pet puppy or a lost ball.

Mothers are urged to dress their youngsters (particularly the little ones who have no sense of danger) in red, or other equally vivid colours.

An added advantage of brighter children's clothing is that children are easier to find if they wander away or get lost at bush picnics or on the beach.

Today, people are using colours for safety in many other ways too.

For example, tests by United States railroad companies show that there is safety in colour combinations of orange and black, or orange and royal blue for train extensions.

These ensure year round visibility in any part of the country and have reduced the risk of level crossing accidents.

—N.S.W. Agriculture Department's "Press Copy."

Keeping Carpets Clean.

Hygenically and economically it is vitally important to keep carpets clean.

Razor-sharpness of tiny particles of gritty dust, if allowed to accumulate, will produce tuft moulting from cuts of carpet fibres under our tread, and shorten the life of the carpet.

Newly laid carpets have a natural tendency to shed. Allow a four to five weeks settling-down period, and do not be alarmed when fluff appears on the surface.

During this time care should be taken not to vacuum clean or over brush.

It is best to pick up fluff and dust, as lightly as possible, with small brush and dustpan, or carpet sweeper, if available.

Regular vacuum cleaning is strongly recommended for all carpets, but for new ones only after the initial settling-in period.

Run the cleaner *against* the pile and finish off *with* the pile of the carpet.

Mishaps which could cause permanent damage to carpets and rugs should be attended to immediately.

Never be too embarrassed by the presence of visitors to clean up thoroughly the affected area. Liquids containing milk or sugar or both, such as tea, coffee and cocoa, become sticky when dry, attracting particles of dirt which will adhere like glue and help to perpetuate the stain which will be difficult to remove later.

Rain damage from open windows, and water from leaking roofs may contain rust which could easily discolour the carpet pile, and could also cause mildew and shrinkage.

Take immediate action. If the saturation is not extensive, and the water is fairly clean, mop it up and dry out the carpet as quickly as possible.

Support the wet part above the floor if possible, and use an electric fan or heater to speed up the drying process. Make sure that the carpet pile is lying in the right direction before drying.

When saturation is extensive and there is a likelihood of dirt or rust in the water, mop up, roll the carpet out of the way and send it to the cleaner as soon as possible.

The longer the delay in getting it to the cleaner, the greater the danger of permanent damage, including mildew.

For those who live in rural areas where cleaners are not so readily available it will be necessary to do the arduous task of cleaning at home.

Mop up at once, shampoo the damaged area with mild detergent lather. Remove every trace of detergent with clean rags rinsed (well-squeezed) in clean, warm water.

Dry the carpet, if necessary outside, by hanging it over several lines.

When dry go over it with a dry scrubbing brush along the pile and finish off by using the vacuum cleaner to bring up the pile.

If you do not wish to ruin your smaller carpets, rugs or runners, never shake, beat on the line or bang them against the wall. They can be given an occasional beating but "face down" on a dry lawn. Best to sweep them with a broom "face up."

Remember to use a sweeper or vacuum cleaner immediately after a party or youngsters to get rid of crumbs and extra dirt before these are embedded in your carpet.

Remember, too, to close the windows on dusty, windy days to save yourself the extra work in cleaning your carpets.

For those who have not kept or have mislaid leaflets on the care of their particular make of carpet, write to your dealer or manufacturer for written information, read it and keep it handy for emergencies.

For multi-coloured carpets in which colours "run" or "bleed", use any one of the dry shampoos available on the market.

Care of Rubber Flooring.

Rubber flooring is attractive and durable, clean, and quiet underfoot. It is easy to care for, but the methods used differ from those applied to other types of floor-covering.

After the rubber is laid, clean the surface with a damp cloth.

Never wash until adhesive is thoroughly set—four or five days after flooring material is laid.

(Rubber is slippery when wet and to prevent accidents any liquids spilt on rubber floors should be wiped up immediately.)

To remove ordinary dust and dirt use a vacuum cleaner, or a soft floor brush or non-oily dry mop. Do not use oil mop or oily sweeping compounds.

To retain that glossy appearance, polish frequently with a clean, soft cloth.

To remove mud and soil, wipe with a mop wrung out in clear, cool water.

For occasional thorough cleaning, wash with an approved rubber-flooring cleaner in preference to soap and detergents.

Strong soaps dry out asphalt, cork, rubber, and linoleum, making them brittle, porous, and hard to clean.

Rinse with clean water. When dry, polish thoroughly.

For an extra-high shine apply a thin coat of waterbase, self-polishing wax. Polish and apply a second thin coat of wax.

Polish thoroughly.

Unless the floor gets a great deal of wear, it should be waxed only occasionally.

If wax is allowed to build up on the surface, it will make the floor dingy-looking.

Always use a water-base wax for rubber, never a naptha-base wax.

Naptha, a solvent, softens and pits the rubber and causes colours to "bleed."

Do not apply varnish, lacquer, shellac or similar products—they cause rubber to dry out, crack and curl.

Regular polishing is the best care you can give a rubber floor.

A floor that receives a fair amount of traffic will benefit from an occasional buffing with No. 00 steel wool.

Painting a Portrait.

An artist painting a picture chooses colours o emphasise the beauty of his subject, or convey he moods and feelings he wishes to express.

Every woman is an artist who paints a self-portrait at least once a day, says Mrs. Sybil Foord, Extension Officer (Women's Service), New South Wales Department of Agriculture.

The canvas she uses is herself, and part of her artist's materials are her clothes. Their colours are used to contrast or blend with skin, hair and features, to make a pleasing picture.

Choice of colours is largely a matter of taste, and often one's personality automatically leads o a good choice.

Bright colours and patterns attract attention and appear to increase size.

Use them to accent a good figure point, such as a small waist, or highlight a feature such as a blue blouse which reflects blue eyes, or a green dress which contrasts with red hair.

Yellowish colours are not becoming to a sallow complexion, and mauve shades should be avoided with a fresh complexion.

Dark or subdued colours appear to reduce the size of larger figures. Lighter coloured skirts will add balance to a top-heavy figure, and bright accessories with a neutral-toned dress will draw eyes away from poor figure proportions.

Red, orange and pink colours are warm, and greens and blues give a cool effect.

Black is severe, and best left alone unless an nteresting face, or compelling personality can offset the severity.

White is youthful, but must be spotless, always. As a trimming, white adds a fresh, crisp effect o any outfit.

Choose a basic colour to work on—it need not be dull. A shade of brown, beige, blue, green, or even pink, navy or black is suitable if you have an unlimited clothing allowance for accessories to brighten and vary these colours.

Colour can emphasise your best features, paricularly if used for accessories rather than the main garment. Blue eyes are reflected, and their colour deepened, by a blue scarf. Shades of brown contrast well with green eyes: grey eyes will be dulled by dark colours, and bright red often spoils the beauty of brown eyes.

Blonde hair is flattered by pastel or light colours, and brown and black hair look best with strong, bright colours.

Most colours can be worn with red-toned hair, but blues and greens are always good.

A sallow skin may be given warmth by pink shades, and a highly coloured complexion toned down by green.

Light colours suit a fresh complexion, but dark colours may make it look deathly pale.

Artists may enjoy and be able to experiment with colours, irrespective of cost. A woman who uses some knowledge and thought when choosing her clothes will find an experiment with colour can be refreshing but need not be costly.

Tips for Tricel.

Tricel is a versatile synthetic fibre that blends easily with other fibres. Tricel labels are seen on baby clothes, men's suits, permanently pleated skirts and frocks, coats (raincoats to housecoats) and lingerie.

To take full advantage of its easy-care properties, the following rules are recommended:—

Follow washing instructions normally found on the label attached to the garment.

Be sure to tell the dry cleaner it is a Tricel-blend garment, so he will know what preparation to use.

Dip Tricel garments into a mixture of warm water and mild soap. Rinse thoroughly in warm water and drip-dry over a coathanger in the shade—never squeeze.

If the garment has soiled spots, make sure all the garment is washed in warm to hot water. To remove spots and stains, rub the marks with mild soap, then rub the fabric gently against itself and follow home-washing instructions.

Double parts, such as collars, cuffs and lapels, may need pressing. Press these parts with a hot iron over a dry pressing-cloth when the garment is very damp, then hang to finish drying.

Check Electrical Appliances

Regular and constant attention to the following points in the use of electricity in the home may save a life—perhaps your own:

Flexible Cords. Do not use a flexible cord with your toaster, hot water jug, iron or other portable appliances, if the outer covering has become frayed.

A frayed cord leaves the live conductors inside unprotected and the flex may fail.

If bodily contact were made with one of the live wires, the consequences could be serious.

Watch out for broken or chipped three pin plugs and appliance plugs. Never plug a cord connecting a portable appliance into a light socket, it is asking for trouble.

Electrical Repairs. If any of your household electrical appliances do not operate satisfactorily don't interfere with them.

Loss of life has occurred due to unauthorised interference.

Have all repairs carried out by a certificated electrician. Your electricity supply authority offers a free testing of your portable electrical appliances when brought to the authority's office or depot.

Electric Wires and Power Lines. When working on your roof keep well away from the electric wires attached to the house.

Although these wires are covered with braiding, it could be unsafe to touch them under certain circumstances.

Sun, wind, and rain cause the braiding to deteriorate and the covered wires should be regarded as no more safe than bare wires.

If you see any fallen electric wires, guard them and arrange to notify the electricity suppl authority or police immediately.

Electric Radiators. Do not use a portable radiator in your bathroom or laundry.

If the radiator is defective, the frame may be "alive," and. if touched in this condition, with damp hands or when standing on a damp floor you will receive a severe or even fatal shock.

The Earthing Conductor. Under no circumstances should an earth wire be interfered with in any way.

This wire, usually made of copper, is run to a suitable position and connected to the water pipes where it enters the house, or to a pipe driven into the ground.

Its purpose is to carry a leakage current to the ground, and permits a fuse to blow in the event of a defect in the installation.

If it is necessary to have the earth wire shifted for any reason, this should be done by an electrical contractor before the necessary plumbing or building alteration work is carried out.

Always remember that the earthing conductor has been installed for your protection and should remain intact.

Washing Machines. Electric washing machines should be permanently wired or connected by means of a 3-core tough rubber or plastic sheathed flexible cord, connected to an earthed 3-pin power point which provides for the effective earthing of the metal frame of the machine.

Never plug the washing machine into a light socket—it is asking for trouble.

Try to avoid using an extension lead. Have an earthed power point installed adjacent to the machine.

Spanners

Nothing could be more annoying when carrying out repairs than to find rounded nuts caused by the use of incorrect tools.

Make it a rule always to use a box or ring spanner wherever possible.

When an open-ended spanner must be used take care in selecting the correct size.

Adjustable spanners which are more often than not found in any farmer's tool kit have their uses, but they should never be employed if another type of the correct size is available. They rarely get a good grip, and the "springiness" of the moving jaw causes them to slip resulting in damage to the nut and possibly a chip off your knuckle as well.

—*C. G. WRAGGE, Agricultural Engineer.*

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